EXCEL IN MATHSCI
HIGHER MATHEMATICS • TOPIC RESOURCE

2026–27
Portfolio 5

Quadratics and Polynomials

PUPIL WORKSHEET

Skills covered: Factorising; quadratic roots and the expression b-squared minus four ac; tangency; factor and remainder theorems; cubic intersections.

Instructions: Attempt all questions. Show sufficient working to justify your answers. Give exact values unless a degree of accuracy is stated. Each section is separate for targeted revision.

Prerequisite core skills revise earlier learning; *topic practice* develops individual techniques; *exam-style and challenge* combines skills.

Pupil: _____ **Date:** _____

SECTION A | Prerequisite core skills

Question 1

[2 marks]

Factorise fully $3x^2 - 11x - 4$.

Question 2

[3 marks]

Solve $2x^2 + 3x - 9 = 0$.

Question 3

[3 marks]

Determine the nature of the roots of $3x^2 - 6x + 5 = 0$. Give a reason.

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Question 4

[3 marks]

Find k if $x^2 + 6x + k = 0$ has equal roots.

Question 5

[2 marks]

Find the remainder when $P(x) = x^3 - 2x^2 - 5x + 6$ is divided by $x - 2$.

Question 6

[3 marks]

Factorise $x^3 - 4x$ fully and solve $x^3 - 4x = 0$.

SECTION B | Topic practice

Question 7

[5 marks]

Show that $x = -1$ is a root of $x^3 - 4x^2 + x + 6 = 0$. Hence solve the equation.

Question 8

[4 marks]

$P(x) = x^3 + ax^2 - 7x + 5$ has a factor $x - 1$. Find a and the remainder when $P(x)$ is divided by $x + 2$.

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Question 9 [5 marks]

The line $y = 2x + k$ is a tangent to $y = x^2 - 4x + 7$. Find k and the point of contact.

Question 10 [4 marks]

Find all real values of p for which $x^2 + (p+1)x + 2p = 0$ has equal roots.

Question 11 [4 marks]

Factorise $x^3 - 3x^2 - 4x + 12$ and state the x-intercepts of the corresponding cubic.

Question 12 [4 marks]

Find the coordinates of the points of intersection of $y = x^2 - 3x + 1$ and $y = x + 1$.

Question 13 [4 marks]

Find all the points where $y = 2x^3 - 5x^2 - 3x$ meets the x-axis.

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Question 14 [3 marks]

The polynomial $P(x) = x^3 - 2x^2 + mx + 6$ has a factor $x + 1$. Find m.

SECTION C | Exam-style and challenge

Question 15 [5 marks]

Show that $x = 1$ is a root of $x^2 + (k+2)x - k - 3 = 0$ for every real k. Find k if the roots are equal.

Question 16 [5 marks]

Find the possible values of m for which $y = mx + 2$ is tangent to $y = x^2 - 4x + 6$.

Question 17 [4 marks]

Solve the equation $x^4 - 5x^2 + 4 = 0$.

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Question 18 [5 marks]

$P(x) = x^3 + kx^2 - 4x - 4k$. Factorise $P(x)$ fully and state the values of k for which $P(x) = 0$ has three distinct real roots.

— End of pupil worksheet —

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