

9709 Mathematics Paper 1 - Quadratics

Topical questions | 58 questions

1. Question | 9709 May-June 2016 P1 V1 Q6

- 6** (a) Find the values of the constant m for which the line $y = mx$ is a tangent to the curve $y = 2x^2 - 4x + 8$. [3]
- (b) The function f is defined for $x \in \mathbb{R}$ by $f(x) = x^2 + ax + b$, where a and b are constants. The solutions of the equation $f(x) = 0$ are $x = 1$ and $x = 9$. Find
- (i) the values of a and b , [2]
- (ii) the coordinates of the vertex of the curve $y = f(x)$. [2]

2. Question | 9709 Oct-Nov 2016 P1 V1 Q1

- 1** (i) Express $x^2 + 6x + 2$ in the form $(x + a)^2 + b$, where a and b are constants. [2]
- (ii) Hence, or otherwise, find the set of values of x for which $x^2 + 6x + 2 > 9$. [2]

3. Question | 9709 Oct-Nov 2016 P1 V2 Q3

- 3** A curve has equation $y = 2x^2 - 6x + 5$.
- (i) Find the set of values of x for which $y > 13$. [3]
- (ii) Find the value of the constant k for which the line $y = 2x + k$ is a tangent to the curve. [3]

4. Question | 9709 Oct-Nov 2016 P1 V3 Q1

- 1** Find the set of values of k for which the curve $y = kx^2 - 3x$ and the line $y = x - k$ do not meet. [3]

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5. Question | 9709 Feb-March 2017 P1 V2 Q1

- 1** Find the set of values of k for which the equation $2x^2 + 3kx + k = 0$ has distinct real roots. [4]

[illegible]

9 **(i)** Express $9x^2 - 6x + 6$ in the form $(ax + b)^2 + c$, where a , b and c are constants. [3]

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The function f is defined by $f(x) = 9x^2 - 6x + 6$ for $x \geq p$, where p is a constant.

(ii) State the smallest value of p for which f is a one-one function. [1]

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6. Question part 2/2 | 9709 May-June 2017 P1 V3 Q9

[illegible][illegible]

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7. Question | 9709 Oct-Nov 2017 P1 V3 Q2

- 2** Find the set of values of a for which the curve $y = -\frac{2}{x}$ and the straight line $y = ax + 3a$ meet at two distinct points. [4]

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9 A curve has equation $y = \frac{1}{x} + c$ and a line has equation $y = cx - 3$, where c is a constant.

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8. Question part 2/2 | 9709 Feb-March 2018 P1 V2 Q9

- (ii) The line is a tangent to the curve for two particular values of c . For each of these values find the x -coordinate of the point at which the tangent touches the curve. [4]

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9. Question | 9709 May-June 2018 P1 V2 Q2

2 The equation of a curve is $y = x^2 - 6x + k$, where k is a constant.

(i) Find the set of values of k for which the whole of the curve lies above the x -axis. [2]

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(ii) Find the value of k for which the line $y + 2x = 7$ is a tangent to the curve. [3]

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10. Question part 1/2 | 9709 May-June 2018 P1 V2 Q7

7 The function f is defined by $f : x \mapsto 7 - 2x^2 - 12x$ for $x \in \mathbb{R}$.

(i) Express $7 - 2x^2 - 12x$ in the form $a - 2(x + b)^2$, where a and b are constants. [2]

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(ii) State the coordinates of the stationary point on the curve $y = f(x)$. [1]

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(iii) State the smallest value of k for which g has an inverse. [1]

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(iv) For this value of k , find $g^{-1}(x)$. [3]

[illegible]

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11. Question | 9709 May-June 2018 P1 V3 Q1

1 Express $3x^2 - 12x + 7$ in the form $a(x + b)^2 + c$, where a , b and c are constants. [3]

[illegible]

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12. Question | 9709 Oct-Nov 2018 P1 V1 Q1

1 Showing all necessary working, solve the equation $4x - 11x^{\frac{1}{2}} + 6 = 0$. [3]

[illegible]

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13. Question | 9709 Oct-Nov 2018 P1 V1 Q2

- 2 A line has equation $y = x + 1$ and a curve has equation $y = x^2 + bx + 5$. Find the set of values of the constant b for which the line meets the curve. [4]

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[illegible]

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14. Question part 2/2 | 9709 Oct-Nov 2018 P1 V2 Q10

[illegible]

(iii) Find the equation of the perpendicular bisector of the line joining A and B . [3]

[illegible]

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9 A curve has equation $y = 2x^2 - 3x + 1$ and a line has equation $y = kx + k^2$, where k is a constant.

(i) Show that, for all values of k , the curve and the line meet. [4]

[illegible]

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(ii) State the value of k for which the line is a tangent to the curve and find the coordinates of the point where the line touches the curve. [4]

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16. Question part 1/2 | 9709 May-June 2019 P1 V1 Q5

5 The function f is defined by $f(x) = -2x^2 + 12x - 3$ for $x \in \mathbb{R}$.

(i) Express $-2x^2 + 12x - 3$ in the form $-2(x + a)^2 + b$, where a and b are constants. [2]

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(ii) State the greatest value of $f(x)$. [1]

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16. Question part 2/2 | 9709 May-June 2019 P1 V1 Q5

The function g is defined by $g(x) = 2x + 5$ for $x \in \mathbb{R}$.

(iii) Find the values of x for which $\text{gf}(x) + 1 = 0$.

[3]

[illegible]

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1 The function f is defined by $f(x) = x^2 - 4x + 8$ for $x \in \mathbb{R}$.

[illegible][illegible]

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6 A straight line has gradient m and passes through the point $(0, -2)$. Find the two values of m for which the line is a tangent to the curve $y = x^2 - 2x + 7$ and, for each value of m , find the coordinates of the point where the line touches the curve. [7]

[illegible]

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18. Question part 2/2 | 9709 Oct-Nov 2019 P1 V1 Q6

[illegible]

$$g(x) = 2x - k \quad \text{for } x \in \mathbb{R},$$

where k is a constant.

- (i) Find the value of k for which the line $y = g(x)$ is a tangent to the curve $y = f(x)$. [3]

[illegible]

- (ii) In the case where $k = -9$, find the set of values of x for which $f(x) < g(x)$. [3]

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19. Question part 2/2 | 9709 Oct-Nov 2019 P1 V2 Q9

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20. Question part 1/2 | 9709 Oct-Nov 2019 P1 V3 Q6

- 6** A line has equation $y = 3kx - 2k$ and a curve has equation $y = x^2 - kx + 2$, where k is a constant.
- (i) Find the set of values of k for which the line and curve meet at two distinct points. [4]

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20. Question part 2/2 | 9709 Oct-Nov 2019 P1 V3 Q6

- (ii) For each of two particular values of k , the line is a tangent to the curve. Show that these two tangents meet on the x -axis. [3]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the paper.

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5 The equation of a line is $y = mx + c$, where m and c are constants, and the equation of a curve is $xy = 16$.

[illegible][illegible]

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6 The equation of a curve is $y = 2x^2 + kx + k - 1$, where k is a constant.

[illegible][illegible]

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23. Question | 9709 May-June 2020 P1 V3 Q1

- 1** Find the set of values of m for which the line with equation $y = mx + 1$ and the curve with equation $y = 3x^2 + 2x + 4$ intersect at two distinct points. [4]

[illegible]

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24. Question | 9709 Oct-Nov 2020 P1 V1 Q1

- 1** Find the set of values of m for which the line with equation $y = mx - 3$ and the curve with equation $y = 2x^2 + 5$ do not meet. [3]

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25. Question | 9709 Oct-Nov 2020 P1 V2 Q3

- 3** The equation of a curve is $y = 2x^2 + m(2x + 1)$, where m is a constant, and the equation of a line is $y = 6x + 4$.

Show that, for all values of m , the line intersects the curve at two distinct points. [5]

[illegible]

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1 (a) Express $x^2 + 6x + 5$ in the form $(x + a)^2 + b$, where a and b are constants. [2]

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- Describe fully the transformation(s) involved. [2]

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4 A curve has equation $y = 3x^2 - 4x + 4$ and a straight line has equation $y = mx + m - 1$, where m is a constant.

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28. Question | 9709 Feb-March 2021 P1 V2 Q2

2 By using a suitable substitution, solve the equation

$$(2x-3)^2 - \frac{4}{(2x-3)^2} - 3 = 0. \quad [4]$$

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29. Question | 9709 Feb-March 2021 P1 V2 Q4

- 4** A line has equation $y = 3x + k$ and a curve has equation $y = x^2 + kx + 6$, where k is a constant.

Find the set of values of k for which the line and curve have two distinct points of intersection. [5]

[illegible]

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6 The equation of a curve is $y = (2k - 3)x^2 - kx - (k - 2)$, where k is a constant. The line $y = 3x - 4$ is a tangent to the curve.

Find the value of k . [5]

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1 (a) Express $16x^2 - 24x + 10$ in the form $(4x + a)^2 + b$. [2]

[illegible]

- Find the value of this root. [2]

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3 A line with equation $y = mx - 6$ is a tangent to the curve with equation $y = x^2 - 4x + 3$.

[illegible]

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2 A curve has equation $y = kx^2 + 2x - k$ and a line has equation $y = kx - 2$, where k is a constant.

Find the set of values of k for which the curve and line do not intersect. [5]

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2 A curve has equation $y = x^2 + 2cx + 4$ and a straight line has equation $y = 4x + c$, where c is a constant.

Find the set of values of c for which the curve and line intersect at two distinct points. [5]

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1 (a) Express $x^2 - 8x + 11$ in the form $(x + p)^2 + q$ where p and q are constants. [2]

[illegible]

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5 The equation of a curve is $y = 4x^2 - kx + \frac{1}{2}k^2$ and the equation of a line is $y = x - a$, where k and a are constants.

- [illegible]

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36. Question part 2/2 | 9709 May-June 2022 P1 V2 Q5

- (b)** Given instead that $a = -\frac{7}{2}$, find the values of k for which the line is a tangent to the curve. [5]

[illegible]

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37. Question | 9709 Oct-Nov 2022 P1 V1 Q1

1 Solve the equation $3x + 2 = \frac{2}{x-1}$. [3]

[illegible]

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6 The equation of a curve is $y = 4x^2 + 20x + 6$.

(a) Express the equation in the form $y = a(x + b)^2 + c$, where a , b and c are constants. [3]

[illegible]

(b) Hence solve the equation $4x^2 + 20x + 6 = 45$. [3]

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38. Question part 2/2 | 9709 Oct-Nov 2022 P1 V2 Q6

- (c) Sketch the graph of $y = 4x^2 + 20x + 6$ showing the coordinates of the stationary point. You are not required to indicate where the curve crosses the x - and y -axes. [3]

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2 The function f is defined by $f(x) = -2x^2 - 8x - 13$ for $x < -3$.

[illegible]

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1 A line has equation $y = 3x - 2k$ and a curve has equation $y = x^2 - kx + 2$, where k is a constant.

Show that the line and the curve meet for all values of k . [4]

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3 (a) Express $4x^2 - 24x + p$ in the form $a(x + b)^2 + c$, where a and b are integers and c is to be given in terms of the constant p . [2]

[illegible]

- [illegible]

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42. Question | 9709 May-June 2023 P1 V2 Q4

4 Solve the equation $8x^6 + 215x^3 - 27 = 0$. [3]

[illegible]

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2 The function f is defined for $x \in \mathbb{R}$ by $f(x) = x^2 - 6x + c$, where c is a constant. It is given that $f(x) > 2$ for all values of x .

Find the set of possible values of c . [4]

[illegible]

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44. Question | 9709 Oct-Nov 2023 P1 V1 Q2

- 2** A line has equation $y = 2cx + 3$ and a curve has equation $y = cx^2 + 3x - c$, where c is a constant.

Showing all necessary working, determine which of the following statements is correct.

- A** The line and curve intersect only for a particular set of values of c .

- B** The line and curve intersect for all values of c .

- C** The line and curve do not intersect for any values of c . [4]

[illegible]

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6 A line has equation $y = 6x - c$ and a curve has equation $y = cx^2 + 2x - 3$, where c is a constant. The line is a tangent to the curve at point P .

[illegible]

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7 The straight line $y = x + 5$ meets the curve $2x^2 + 3y^2 = k$ at a single point P .

[illegible][illegible]

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1 (a) Express $3y^2 - 12y - 15$ in the form $3(y+a)^2 + b$, where a and b are constants. [2]

[illegible]

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11 The function f is defined by $f(x) = 10 + 6x - x^2$ for $x \in \mathbb{R}$.

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(b) It is given that the graph of $y = g^{-1}f(x)$ meets the graph of $y = g(x)$ at a single point P .

[6]

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If you use the following page to complete the answer to any question, the question number must be clearly shown.

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49. Question | 9709 Oct-Nov 2024 P1 V1 Q4

- 4** Show that the curve with equation $x^2 - 3xy - 40 = 0$ and the line with equation $3x + y + k = 0$ meet for all values of the constant k . [5]

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50. Question part 1/2 | 9709 Oct-Nov 2024 P1 V2 Q9

- 9 The equation of a curve is $y = \frac{1}{2}k^2x^2 - 2kx + 2$ and the equation of a line is $y = kx + p$, where k and p are constants with $0 < k < 1$.

- (a)** It is given that one of the points of intersection of the curve and the line has coordinates $\left(\frac{5}{2}, \frac{1}{2}\right)$.

Find the values of k and p , and find the coordinates of the other point of intersection. [7]

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50. Question part 2/2 | 9709 Oct-Nov 2024 P1 V2 Q9

[illegible]

- (b) It is given instead that the line and the curve do **not** intersect.

Find the set of possible values of p .

[3]

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51. Question | 9709 Feb-March 2025 P1 V2 Q1

- 1** A curve has equation $y = 5 + 3x - 2x^2$ and a straight line has equation $y = kx + 13$, where k is a constant.

Find the set of values of k for which the curve and the line do **not** meet. [4]

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52. Question part 1/2 | 9709 May-June 2025 P1 V1 Q6

- 6** The equation of a curve is $2x^2 - kxy + 2 = 0$ and the equation of a line is $y = px + 3$, where k and p are constants.
- (a)** Given that $k = 2$ and $p = 11$, find the coordinates of the points of intersection of the curve and the line. [4]

[illegible]

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52. Question part 2/2 | 9709 May-June 2025 P1 V1 Q6



- (b)** Given instead that $p = 4$, find the set of values of k for which the curve and the line do not intersect. [5]

[illegible]

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53. Question part 1/2 | 9709 May-June 2025 P1 V2 Q2

2 Find the coordinates of the points of intersection of the curve and the line with equations

$$2xy + 5y^2 = 24 \quad \text{and} \quad 2x + y + 4 = 0. \quad [4]$$

[illegible]

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53. Question part 2/2 | 9709 May-June 2025 P1 V2 Q2



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54. Question | 9709 Oct-Nov 2025 P1 V1 Q1

1 Find the set of values of the constant k for which the quadratic equation

$$3kx^2 + (k+8)x + 3 = 0$$

has two distinct real roots. [4]

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1 (a) Express $9x^2 - 36x + 8$ in the form $p(x+q)^2 + r$, where p , q and r are constants. [2]

[illegible]

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10 A function f is defined by $f(x) = px^2 + 4x + q$ for $x \in \mathbb{R}$, where p and q are constants.

(i) Express $f(x)$ in the form $a(x+b)^2+c$, where a , b and c are constants. [3]

[illegible]

(ii) State the range of f . [1]

[illegible]

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56. Question part 2/2 | 9709 Oct-Nov 2025 P1 V3 Q10



- (b)** It is given instead that $q = -5$ and the roots of $f(x) = 0$ are $5m$ and $-9m$, where m is a constant.

Find the values of p and m .

[5]

[illegible]

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3 (a) Express $4x^2 + 10x + 6$ in the form $a(x+b)^2 + c$, where a , b and c are rational constants to be determined. [2]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- Using your answer to part (a) or otherwise, state the value of the constant k . [1]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

9709 Mathematics Paper 1 - Quadratics

Topical questions | 58 questions

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5 Solve the equation

$$x^3 - 28 + \frac{27}{x^3} = 0. \quad [3]$$

This image shows a full page of a document template designed for handwriting practice or general note-taking. It consists of approximately 28 evenly spaced, horizontal dotted lines extending across the width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.