

GCSE MATHEMATICS - HIGHER TIER

Quadratics

Exam-Style Assignment

STUDENT DETAILS

Name: _____

Date: _____ Target grade / level: _____

ASSIGNMENT FOCUS

- Expand, simplify and factorise quadratic expressions
- Solve by factorising, completing the square and the formula
- Interpret and sketch graphs, turning points and transformations
- Solve inequalities, simultaneous equations and quadratic sequences
- Model real-life situations and tackle Higher-tier reasoning

38 ORIGINAL QUESTIONS | 148 MARKS | Suggested time: 3-4 study sessions

Instructions: Answer every question. Show your full working. Use graph paper provided.

Calculator permitted except where a question specifies an exact answer.

Independent practice informed by AQA, Pearson Edexcel and OCR specifications. Not an official paper.

Section A - Expanding and factorising

Show the algebraic steps. Factorise fully wherever requested.

1. Expand and simplify $(x + 7)(x - 3)$.

[2 marks]

2. Expand and simplify $(3x - 2)(x + 4)$.

[3 marks]

3. Simplify $(x - 3)^2 - (x + 2)(x - 5)$.

[3 marks]

4. Factorise $x^2 + 2x - 35$.

[2 marks]

Section A - Expanding and factorising (continued)

5. Factorise $3x^2 + 14x + 8$.

[3 marks]

6. Factorise $16x^2 - 49$.

[2 marks]

7. Factorise $2x^2 - 9x - 5$.

[3 marks]

8. Factorise fully $6x^2 - 54$.

[3 marks]

Section A - Expanding and factorising (continued)

9. Write down a quadratic equation with roots -2 and 5 , and coefficient of x^2 equal to 3 . Give your answer in the form $ax^2 + bx + c = 0$. **[3 marks]**

Section B - Solving quadratic equations

Give all real solutions. Use an appropriate algebraic method and show working.

10. Solve $x^2 - 6x - 27 = 0$.

[3 marks]

11. Solve $2x^2 + 7x - 4 = 0$.

[4 marks]

12. Solve $x(x - 6) = 27$. Rearrange your equation into the form $ax^2 + bx + c = 0$ first.

[4 marks]

13. Solve $3x^2 = 15x$.

[3 marks]

Section B - Solving quadratic equations (continued)

14. Solve $(x + 4)^2 = 13$. Give both answers in exact form. [3 marks]

15. Solve $x^2 + 8x + 2 = 0$ by completing the square. Give exact solutions. [5 marks]

16. Solve $3x^2 - 4x - 2 = 0$ using the quadratic formula. Give your answers correct to 3 significant figures. [5 marks]

Section B - Solving quadratic equations (continued)

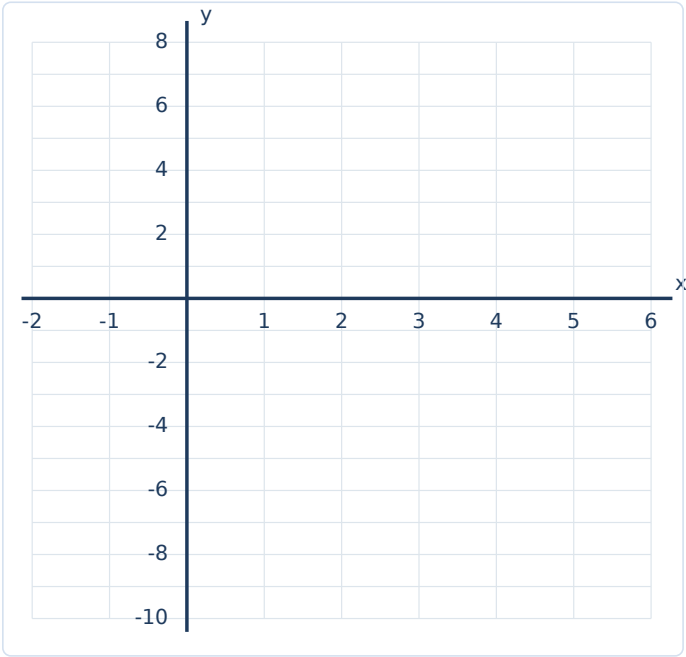
- 17.** Show that $4x^2 + 4x + 5 = 0$ has no real solutions. You must justify your answer using the discriminant. **[3 marks]**

Section C - Quadratic graphs and transformations

Use accurate diagrams, correct scales and labelled coordinates.

18. Complete the table for $y = x^2 - 4x - 5$. Plot the seven points on the grid and draw a smooth curve. [6 marks]

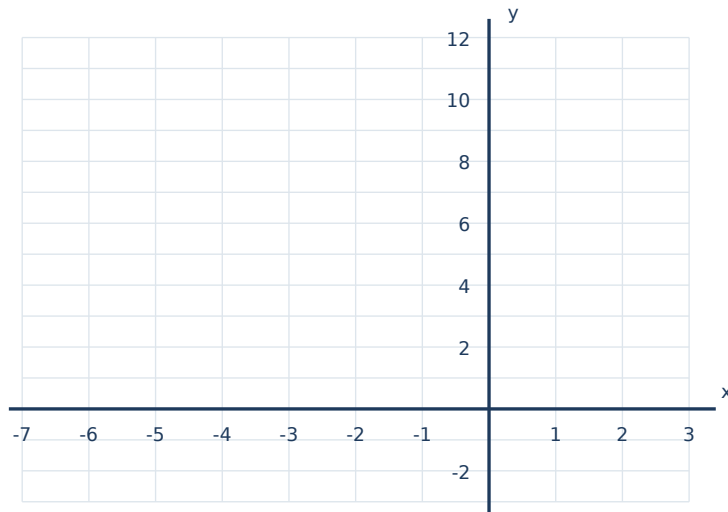
x	-1	0	1	2	3	4	5
y							



19. Using your curve from Question 18, state: (a) both roots; (b) the equation of the line of symmetry; (c) the coordinates of the turning point. [3 marks]

Section C - Quadratic graphs and transformations (continued)

- 20.** Sketch $y = -(x - 1)(x + 5)$ on the axes. Label both x-intercepts, the y-intercept and the coordinates of its turning point.

[5 marks]

- 21.** Write $y = 2x^2 - 12x + 13$ in the form $y = 2(x - a)^2 + b$. Hence state the turning point and the minimum value of y .

[4 marks]

- 22.** Describe fully the transformations that map $y = x^2$ onto $y = (x + 4)^2 - 7$.

[3 marks]

Section D - Inequalities and simultaneous equations

Write inequality answers clearly, including endpoint signs.

23. Solve $x^2 - x - 12 > 0$. Give your answer using inequalities. [4 marks]

24. Solve $2x^2 + 3x - 2 \leq 0$. Show your solution set on the number line provided. [4 marks]



25. Solve simultaneously: $y = x^2 - 4x + 1$ and $y = 2x - 7$. Give both coordinate pairs. [5 marks]

Section D - Inequalities and simultaneous equations (continued)

26. For $f(x) = x^2 + x - 7$, calculate $f(2.19)$ and $f(2.20)$. Hence show that a root lies between 2.19 and 2.20 and give the positive root correct to 2 decimal places. [4 marks]

27. A student claims: “If $x^2 < 9$, then $x < 3$.” Explain why this is incomplete and write the correct solution set. [3 marks]

Section E - Quadratic sequences

Use differences and show how you obtain an nth-term rule.

28. The sequence is 5, 12, 23, 38, 57, ... (a) Find the next term. (b) Find an expression for the nth term. [5 marks]

29. The nth term of a sequence is $3n^2 - 2n + 4$. (a) Write the first three terms. (b) Show that 100 is a term and state which term it is. [4 marks]

30. A pattern of tiles has n rows, with n + 3 tiles in each row. (a) Write a quadratic expression for the total number of tiles T. (b) Find T when n = 5. (c) Find n when T = 88. [5 marks]

Section F - Forming equations in context

Form and solve a quadratic; reject values that are impossible in context.

31. A rectangle has length $(x + 7)$ cm and width $(x - 2)$ cm. Its area is 52 cm^2 . Form a quadratic equation and find the length and width. [5 marks]

32. The product of two consecutive positive integers is 182. Form and solve a quadratic equation to find the integers. [4 marks]

Section F - Forming equations in context (continued)

33. A ball is launched from a platform. Its height h metres after t seconds is given by $h = -5t^2 + 20t + 1$. (a) Find the two times when $h = 16$. (b) Find the maximum height and when it occurs. [6 marks]

34. A right-angled triangle has shorter sides x cm and $(x + 7)$ cm. Its hypotenuse is 13 cm. Form a quadratic equation and find the two shorter side lengths. [5 marks]

Section F - Forming equations in context (continued)

35. A rectangular garden has a perimeter of 40 m. Its width is x m. (a) Show that its area is $A = 20x - x^2$. (b) Find its greatest possible area. (c) Find both possible widths when the area is 96 m^2 . [6 marks]

Section G - Higher-tier reasoning challenge

These final questions assess deeper connections and justification.

36. The equation $x^2 + (k - 2)x + 9 = 0$ has exactly one repeated real root. Find all possible values of k . You must show your method. [5 marks]

37. A quadratic has roots $1 + \sqrt{3}$ and $1 - \sqrt{3}$. Find a quadratic equation with integer coefficients and coefficient of x^2 equal to 1. [4 marks]

38. Find the range of values of p for which $x^2 - 2px + 16 = 0$ has two distinct real roots. Give your answer as inequalities. [4 marks]