

GCSE / IGCSE Maths – Algebra

GCSE/IGCSE (Higher) · Total marks: 60 · Answers on the last page

Higher-tier practice covering expanding and factorising, linear and quadratic equations, inequalities, simultaneous equations, sequences, functions and rearranging formulae. Section A is non-calculator; a calculator may be used for Sections B and C. Allow about 60 minutes.

Section A – Skills (Non-calculator.)

- Expand and simplify $(2x - 3)(x + 5)$.
 - Expand $(x + 4)^2$.
 - Factorise fully $9x^2 - 16$.
 - Factorise $3x^2 + 7x - 6$. [7]
- Solve
 - $3(2x - 1) = 4x + 7$
 - $\frac{x + 2}{3} - \frac{x - 1}{4} = 2$ [5]
- Here are the first four terms of a sequence: 5, 9, 13, 17.
 - Write down an expression for the n th term.
 - Is 203 a term of the sequence? Justify your answer.
 - The first three terms of a geometric sequence are 3, 6, 12. Write down the n th term. [5]
- Solve the simultaneous equations
 - $$3x + 2y = 12$$

$$5x - 2y = 4$$
 [3]
- Solve the inequality $5x - 3 > 2x + 9$.
 - Write down the integer values of x that satisfy $-4 < 2x \leq 6$. [4]

Section B – Exam-style (Calculator allowed.)

- Solve $2x^2 - 5x - 3 = 0$ by factorising.
 - Solve $2x^2 - 3x - 7 = 0$, giving your answers correct to 3 significant figures. [6]
- The functions f and g are defined by $f(x) = 3x - 2$ and $g(x) = x^2 + 1$.
 - Find $fg(2)$.
 - Find an expression for $gf(x)$, simplifying your answer.
 - Find $f^{-1}(x)$. [6]
- Make x the subject of $y = \frac{2x + 3}{x - 1}$. [4]
- The n th term of a quadratic sequence is given by the first four terms 2, 7, 16, 29. Find an expression for the n th term. [4]
- Write $2x^2 + 12x + 5$ in the form $a(x + b)^2 + c$.
 - Hence write down the coordinates of the turning point of the graph of $y = 2x^2 + 12x + 5$. [4]

Section C – Problem solving (Calculator allowed.)

11. Solve the simultaneous equations

$$x^2 + y^2 = 25$$

$$y = x + 1$$

[5]

12. (a) Show that the equation $x^3 - 5x - 2 = 0$ has a solution between $x = 2$ and $x = 3$.
(b) Show that the equation can be rearranged to $x = \sqrt[3]{5x + 2}$.
(c) Starting with $x_0 = 2$, use the iteration $x_{n+1} = \sqrt[3]{5x_n + 2}$ to find x_1 , x_2 and x_3 to 4 decimal places.
(d) Solve the inequality $x^2 - 2x - 15 < 0$.

[7]

Answers

Check your working against these. If an answer does not match, try the question again before looking for the method.

1. (a) $2x^2 + 7x - 15$
 (b) $x^2 + 8x + 16$
 (c) $(3x - 4)(3x + 4)$
 (d) $(3x - 2)(x + 3)$
2. (a) $6x - 3 = 4x + 7, x = 5$
 (b) $4(x + 2) - 3(x - 1) = 24 \Rightarrow x + 11 = 24, x = 13$
3. (a) $4n + 1$
 (b) $4n + 1 = 203 \Rightarrow n = 50.5$, not a whole number, so no.
 (c) $3 \times 2^{n-1}$
4. Adding: $8x = 16, x = 2, y = 3$
5. (a) $3x > 12, x > 4$
 (b) $-2 < x \leq 3: -1, 0, 1, 2, 3$
6. (a) $(2x + 1)(x - 3) = 0, x = -\frac{1}{2}$ or $x = 3$
 (b) $x = \frac{3 \pm \sqrt{65}}{4}, x = 2.77$ or $x = -1.27$
7. (a) $g(2) = 5, f(5) = 13$
 (b) $(3x - 2)^2 + 1 = 9x^2 - 12x + 5$
 (c) $f^{-1}(x) = \frac{x + 2}{3}$
8. $y(x - 1) = 2x + 3 \Rightarrow xy - 2x = y + 3 \Rightarrow x = \frac{y + 3}{y - 2}$
9. First differences 5, 9, 13; second difference 4, so $2n^2$ term. Subtracting $2n^2$ leaves 0, -1, -2, -3 = $1 - n$. n th term = $2n^2 - n + 1$
10. (a) $2(x + 3)^2 - 13$
 (b) $(-3, -13)$
11. $x^2 + (x + 1)^2 = 25 \Rightarrow 2x^2 + 2x - 24 = 0 \Rightarrow (x + 4)(x - 3) = 0$.
 $x = 3, y = 4$ or $x = -4, y = -3$
12. (a) $f(2) = -4 < 0, f(3) = 12 > 0$; sign change so a root lies between 2 and 3.
 (b) $x^3 = 5x + 2 \Rightarrow x = \sqrt[3]{5x + 2}$
 (c) $x_1 = 2.2894, x_2 = 2.3780, x_3 = 2.4038$
 (d) $(x - 5)(x + 3) < 0$, so $-3 < x < 5$

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