

Algebra

Edexcel IGCSE Maths (4MA1) · Knowledge organiser

KEY DEFINITIONS

Linear Equations and Inequalities

An inequality replaces '=' with '<', '>', '≤', '≥'.
Solve like an equation — but flip the inequality if you multiply/divide by a negative.

Factorising Quadratics

Factorising $x^2 + bx + c$ means finding two brackets that multiply back to the quadratic.

Linear Simultaneous Equations

Simultaneous equations are two equations in two unknowns. Solve by elimination, substitution, or graphically.

Completing the Square

Completing the square rewrites $x^2 + bx$ as $(x + b/2)^2 - (b/2)^2$ — useful for finding the vertex of a parabola.

YOU SHOULD BE ABLE TO...

- Evaluate and use zero, negative and fractional indices, such as 5^0 , 2^{-3} and $27^{(2/3)}$, and simplify algebraic expressions with these powers.
- Factorise quadratic expressions of the form $ax^2 + bx + c$, such as $3x^2 + 10x - 8$, using grouping or another systematic method.
- Solve pairs of linear simultaneous equations by elimination, including those where both equations must be multiplied first.
- Show that algebraic statements are identities by expanding and simplifying, and set out 'show that' answers so every step is clear.
- Solve equations with algebraic fractions by multiplying through by a common denominator, including equations that lead to quadratics.
- Solve quadratic inequalities such as $x^2 - x - 6 < 0$ using the graph or a sign diagram, and give the solution set.

COMMON MISTAKES

- ✗ Completing the square with a negative x^2 coefficient
- ✗ Simultaneous equations with a quadratic: expanding $(5 - x)^2$
- ✗ Writing $3a \times 2a = 6a$
- ✗ Collecting unlike terms such as x and x^2

KEY FORMULAS

B = given in the exam (formula booklet or list); learn the rest.

Expanding $(a + b)^2 = a^2 + 2ab + b^2$,
 $(a - b)^2 = a^2 - 2ab + b^2$,
 $a^2 - b^2 = (a + b)(a - b)$

Quadratic formula,
 $ax^2 + bx + c = 0$ **B** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Completing the square $x^2 + bx + c = \left(x + \frac{b}{2}\right)^2 - \frac{b^2}{4} + c$

Turning point of
 $y = (x + p)^2 + q$ $(-p, q)$

Arithmetic series,
sum of n terms **B** $S_n = \frac{n}{2}[2a + (n - 1)d]$

Arithmetic n th
term $u_n = a + (n - 1)d$

Proportion $y \propto x^n \Rightarrow y = kx^n$; $y \propto \frac{1}{x^n} \Rightarrow y = \frac{k}{x^n}$

Functions $fg(x) = f(g(x))$; f^{-1} : swap x, y and rearrange

Transformations: $f(x) + a$ up a ; $f(x + a)$ left a ; $-f(x)$ reflect in x -axis; $f(-x)$ reflect in y -axis

Inequalities: multiplying or dividing by a negative number reverses the sign

WORKED EXAMPLE

Solve $y = x + 1$ and $x^2 + y^2 = 25$.

1. $x^2 + (x + 1)^2 = 25 \rightarrow x^2 + x - 12 = 0 \rightarrow x = 3$ or $-4 \rightarrow (3, 4)$ and $(-4, -3)$.