

Algebra and graphs

Cambridge IGCSE Maths (0580) · Knowledge organiser

KEY DEFINITIONS

Expression, equation, identity

An expression has no equals sign; an equation is true for some values; an identity ($\equiv$) is true for all values.

Subject of a formula

The single letter on its own on one side, as v in $v = u + at$.

nth term

A rule that gives any term of a sequence from its position n .

Inverse function

$f^{-1}(x)$ undoes $f(x)$: swap x and y and rearrange.

YOU SHOULD BE ABLE TO...

- Complete a short baseline check on number and algebra from earlier years so the teacher can see what each student already knows and plan the first unit.
- Solve linear equations, including those with brackets and with unknowns on both sides, and check each solution by substitution.
- Write quadratic expressions such as $x^2 - 8x + 3$ and $2x^2 + 6x - 1$ in completed-square form.
- Draw graphs of linear, quadratic and reciprocal functions from tables of values, using suitable scales and smooth curves.
- Use function notation such as $f(x) = 2x + 3$, evaluate functions and find their domain and range, including values that must be excluded.
- Find acceleration and deceleration from speed-time graphs and the distance travelled as the area under the graph.

COMMON MISTAKES

- ✗ Inverse functions: left in terms of y , or a sign slip
- ✗ Composite functions: $gg(x)$ is not $g(x) \times g(x)$
- ✗ Expanding brackets with a negative in front
- ✗ Speed-time graphs: units and the sign of a deceleration

KEY FORMULAS

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

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

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

Difference of two squares $a^2 - b^2 = (a + b)(a - b)$

Linear sequence, n th term $u_n = a + (n - 1)d$

Exponential sequence $u_n = ar^{n-1}$

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

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

Straight line: $y = mx + c$, gradient m , y -intercept c ; vertical line $x = k$

Gradient from two points $m = \frac{y_2 - y_1}{x_2 - x_1}$

Midpoint; length $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$, $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Parallel lines $m_1 = m_2$

Perpendicular lines $m_1 \times m_2 = -1$

Differentiation $y = ax^n \Rightarrow \frac{dy}{dx} = anx^{n-1}$

Turning points: $\frac{dy}{dx} = 0$; the gradient of the curve at $x = a$ is the value of $\frac{dy}{dx}$ at a

WORKED EXAMPLE

Solve the simultaneous equations $3x + 2y = 12$ and $x - y = 4$.

- From the second equation, $x = y + 4$
- $3(y + 4) + 2y = 12$, so $5y = 0$ and $y = 0$
- $x = 0 + 4$

Answer: $x = 4, y = 0$