

Graphs, sequences and calculus

Edexcel IGCSE Maths (4MA1) · Knowledge organiser

KEY DEFINITIONS

Linear Graphs

A linear graph is $y = mx + c$ where m is the gradient (rise/run) and c is the y-intercept.

Sequences

A sequence is a list of numbers with a pattern. The n th-term rule generates any term from its position.

Quadratic Graphs

A quadratic graph is a parabola $y = ax^2 + bx + c$. Its vertex is the min ($a > 0$) or max ($a < 0$).

Differentiation

Differentiating gives the gradient function: bring the power down and reduce it by one ($x^n \rightarrow nx^{n-1}$).

KEY FORMULAS

Straight line $y = mx + c$, $m = \frac{y_2 - y_1}{x_2 - x_1}$

Parallel;
perpendicular $m_1 = m_2$; $m_1 \times m_2 = -1$

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

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

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

Kinematics $v = \frac{ds}{dt}$, $a = \frac{dv}{dt}$

Distance-time gradient = speed; velocity-time gradient = acceleration, area = distance

YOU SHOULD BE ABLE TO...

- Use term-to-term rules to continue sequences and find and use the n th term of linear sequences, such as deciding whether 100 is a term.
- Find the roots, y-intercept and line of symmetry of a quadratic graph, and use the graph to solve related equations.
- Find the sum of an arithmetic series using the formula $S_n = \frac{1}{2}n[2a + (n - 1)d]$, and find unknown terms from a given sum.
- Find the domain and range of functions, and identify values that must be excluded from the domain, such as $x = 2$ for $1/(x - 2)$.
- Draw and interpret the graph of $y = \tan x$, describe its asymptotes and period, and use symmetry to find several solutions of trigonometric equations.
- Find turning points by setting the derivative equal to zero, and solve optimisation and kinematics problems using differentiation.

COMMON MISTAKES

- ✗ Graph transformations of $f(x)$
- ✗ Differentiation: forgetting the negative root and the context
- ✗ Giving the n th term as $n + d$ instead of $dn + c$
- ✗ Reading gradient as change in x over change in y

WORKED EXAMPLE

Find the turning point of $y = x^2 - 6x + 1$.

1. $dy/dx = 2x - 6 = 0 \rightarrow x = 3$, $y = -8$. $d^2y/dx^2 = 2 > 0 \rightarrow$ minimum $(3, -8)$.