IGCSE MATHEMATICS • EXERCISE SHEET

E2.10 Graphs of functions

Name: ____________ Class: ________ Date: __________ **Total: 28 marks**

KEY WORDS table of values 数值表 • coordinates 坐标 • axis 坐标轴 • function 函数 • roots 根

Objective

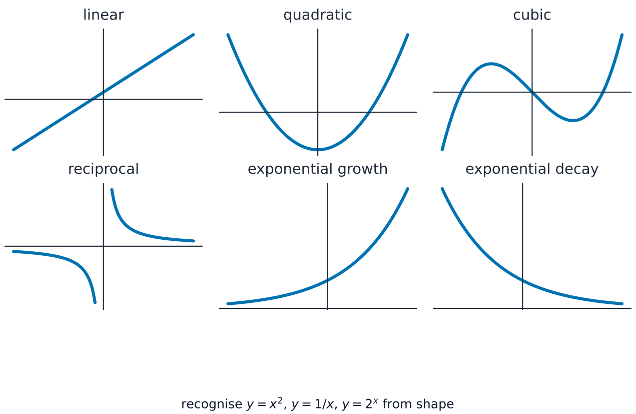
Build the skills to answer Extended exam questions on **graphs of functions** 函数图象 — making a **table of values** 数值表, finding **roots** 根 (where the graph crosses the x-axis), and reading solutions from a graph.

You must be able to:

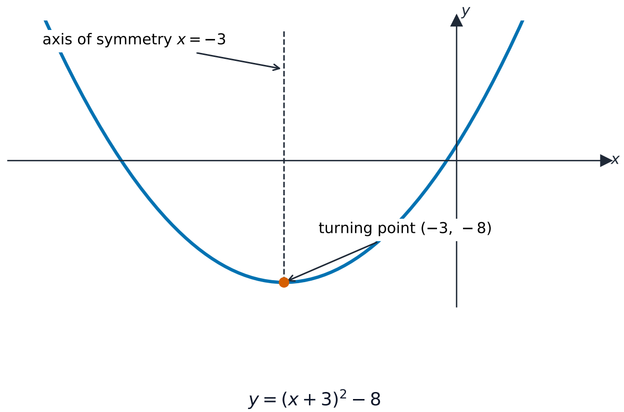
- complete a table of values for a function
- identify the roots and the y-intercept of a graph
- use a graph to solve an equation

1 Worked examples

Tables, roots and intersections



Plot points from a table, then join with a smooth curve



The quadratic is one key function graph

- **Table:** for $y = x^2 - 3$, when $x = 2$, $y = 4 - 3 = 1$.
- **Roots** 根: where $y = 0$ (the graph crosses the x-axis).
- **Solve from a graph:** the **intersection** 交点 of a line and a curve solves the two together.

Answer shapes: M1 a correct method, **A1** the correct answer.

Reading a graph, and solving with a line

The **roots** are where the curve crosses the x-axis, so they are the solutions of $y = 0$. The **y-intercept** is the value at $x = 0$. The **turning point** of $y = ax^2 + bx + c$ lies on the line of symmetry $x = -\dfrac{b}{2a}$; substitute that x back to get its y.

Solving with a drawn line. To solve an equation using a drawn curve, rearrange it so that one side is exactly the curve's equation; the other side is then the line to draw, and the solutions are the x-coordinates where the curve and line cross.

Worked example. The curve $y = x^2 - 2x - 3$ is drawn. Use it to solve $x^2 - 2x - 8 = 0$.

1. Rearrange so the left side matches the drawn curve: $x^2 - 2x - 8 = 0$ becomes $x^2 - 2x - 3 = 5$.
2. So draw the horizontal line $y = 5$.
3. Read the x-coordinates where the curve meets it: $x = -2$ and $x = 4$.
4. Check by factorising: $(x-4)(x+2) = 0$, which agrees.

Sketching. Give the shape (a positive x^2 term opens upwards, a negative one opens downwards), the roots, the y-intercept and the turning point. For a cubic, the shape rises from bottom-left to top-right when the x^3 term is positive, and the roots are still where it crosses the x-axis.

2 Practice

2.1 For $y = x^2 - 4$, find the value of y when $x = 3$. [1]

2.2 Write down the y-intercept of $y = 2x^2 - 5$. [1]

2.3 Find the roots of $y = x^2 - 9$. [2]

2.4 Find the coordinates of the turning point of $y = x^2 - 6x + 5$. [3]

2.5 State the line you would draw on the graph of $y = x^2 + x$ to solve $x^2 + x - 4 = 0$. [1]

3 Exam-style questions

3.1 $y = x^2 - 2x - 3$.

(a) Complete the value of y when $x = -2$. [1]

(b) Find the roots of $x^2 - 2x - 3 = 0$. [2]

3.2 The graph of $y = x^2 - 2x - 3$ is drawn. By solving a quadratic, find the x-values where the graph meets the line $y = 5$. [3]

3.3 The curve $y = x^2 - 4x + 1$ is to be drawn for $-1 \leqslant x \leqslant 5$.

(a) Complete the table of values. [3]

x	-1	**0**	**1**	**2**	**3**	**4**	**5**
y							

(b) Write down the coordinates of the turning point of the curve. [3]

(c) Use the curve to solve $x^2 - 4x + 1 = 0$, giving your answers correct to 1 decimal place. [2]

(d) By drawing a suitable straight line, explain how you would solve $x^2 - 4x - 2 = 0$, and give the equation of that line. [2]

(e) Solve $x^2 - 4x - 2 = 0$ algebraically, giving your answers correct to 2 decimal places. [4]