

C2.10 Graphs of functions

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS axis 坐标轴 • function 函数 • roots 根 • linear 一次 • quadratic 二次

Objective

Use graphs of functions to solve Core IGCSE Mathematics problems.

You must be able to:

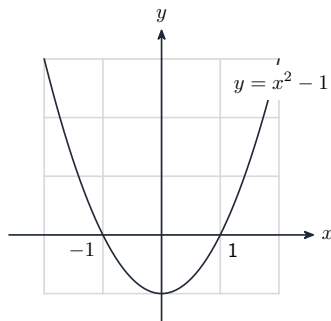
- Complete value tables and plot smooth function graphs
- Keep reciprocal branches separate across zero
- Read equations from intersections of plotted curves or lines

1 Key knowledge and worked examples

■ Key knowledge: Graphs of functions

Make a table by substituting each x into the function. Plot (x, y) pairs on labelled axes. Join a linear function with a ruler; draw a quadratic or reciprocal as a smooth curve. For a/x , omit $x = 0$ and keep the two branches separate. A root is an x -axis crossing. Intersections give solutions where two graphs have the same y value.

■ Worked example: Graphs of functions



For $y = x^2 - 1$, values at $x = -2, -1, 0, 1, 2$ are 3, 0, -1, 0, 3; plot them and draw a smooth U-shaped curve.

- Roots are $x = -1, 1$, where $y = 0$.
- For $y = 4/x$, points include $(1, 4), (2, 2), (4, 1)$ and $(-1, -4), (-2, -2), (-4, -1)$; no point exists at $x = 0$.

- Intersections of $y = x^2 - 1$ and $y = 3$ give $x = -2, 2$.

■ Method check

A reciprocal function is undefined at zero. A line joining points on opposite sides of zero would falsely suggest values the function does not have.

2 Practice

2.1 For $y = 2x - 3$, find y when $x = -1, 0, 2$. [2]

2.2 For $y = -x^2 + 4$, find y when $x = -2, -1, 0, 1, 2$. [2]

2.3 For $y = 6/x$, give the points for $x = -3, -2, 2, 3$. State the excluded x value. [2]

2.4 On graph paper, draw $y = x^2 - 4$ for $-3 \leq x \leq 3$ and read its roots. [2]

3 Exam-style questions

3.1 Apply the graphs of functions methods below. Show working and include units where appropriate.

(a) Complete a table for $y = x^2 - 2$ at integer x from -2 to 2 . [2]

(b) Draw the curve and the horizontal line $y = 2$ on graph paper. [2]

(c) Read the two solutions of $x^2 - 2 = 2$ from the intersections. [2]

3.2 Use the function $y = 12/x$.

(a) Calculate y for $x = -6, -3, -2, 2, 3, 6$. Plot the points and draw the two smooth branches on graph paper. [3]

(b) Draw $y = 4$ on the same axes and read the solution of $12/x = 4$. Explain why the curve has no point with $x = 0$. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- Substitution gives $-5, -3, 1$ respectively.

2.2

- Square before applying the minus: $0, 3, 4, 3, 0$.

2.3

- The points are $(-3, -2), (-2, -3), (2, 3), (3, 2)$; $x = 0$ is excluded.

2.4

- Values are $5, 0, -3, -4, -3, 0, 5$ at integer x . A smooth curve crosses at $x = -2, 2$.

3.1

(a)

- In order, $y = 2, -1, -2, -1, 2$.

(b)

- **Smooth symmetric curve through the five points; ruled horizontal line at $y = 2$.**

(c)

- The crossings are $(-2, 2), (2, 2)$: $x = -2, 2$.

3.2

(a)

- Table values are **$-2, -4, -6, 6, 4, 2$** , in the stated order.
- Plot accurately and draw two smooth branches without joining across zero.

(b)

- The horizontal line $y = 4$ meets the positive branch at $x = \mathbf{3}$.
- At $x = 0$, $12/x$ would divide by zero, so no point is defined.