

Exercise walk-through

E2.10

Graphs of functions

IGCSE Mathematics

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

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The method

Method — Tables, roots and intersections

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

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

Exercises 2.1·2.3

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]

Exercises 2.1·2.3

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

[1]

2.1

- $y = 3^2 - 4 = \mathbf{5}$

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

[1]

2.2

- y -intercept at $x = 0$: $\mathbf{y = -5}$

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

[2]

2.3

- $x^2 - 9 = 0$ so $(x + 3)(x - 3) = 0$
- $\mathbf{x = 3}$ or $\mathbf{x = -3}$

Exercises 2.4·2.5

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]

Exercises 2.4·2.5

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

2.4

- $x = -\frac{-6}{2} = 3$
 - $y = 9 - 18 + 5 = -4$
 - turning point (**3**, **-4**)
-

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

2.5

- $x^2 + x - 4 = 0$ means $x^2 + x = 4$, so draw **y = 4**

Exercise 3.1 (a)

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

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

[1]

Exercise 3.1 (a)

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

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

[1]

(a)

- $y = (-2)^2 - 2(-2) - 3 = 4 + 4 - 3 = \mathbf{5}$

Exercise 3.1 (b)

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

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

[2]

Exercise 3.1 (b)

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

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

[2]

(b)

- $(x - 3)(x + 1) = 0$
- **$x = 3$ or $x = -1$**

Exercise 3.2

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]

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3.2

- $x^2 - 2x - 3 = 5$ so $x^2 - 2x - 8 = 0$
- $(x - 4)(x + 2) = 0$
- $x = 4$ or $x = -2$

Exercise 3.3 (a)

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

(a) Complete the table of values.

[3]

x	-1	0	1	2	3	4	5
y							

Exercise 3.3 (a)

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

(a) Complete the table of values.

[3]

x	-1	0	1	2	3	4	5
y							

(a)

- y values: **6, 1, -2, -3, -2, 1, 6**

Exercise 3.3 (b)

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

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

[3]

Exercise 3.3 (b)

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

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

(b)

- $x = -\frac{-4}{2} = 2$
- $y = 4 - 8 + 1 = -3$
- turning point (**2**, **-3**)

Exercise 3.3 (c)

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

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

Exercise 3.3 (c)

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

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

(c)

- the curve crosses the x -axis at about $\mathbf{x = 0.3}$ and $\mathbf{x = 3.7}$

Exercise 3.3 (d)

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

(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]

Exercise 3.3 (d)

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

(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]

(d)

- $x^2 - 4x - 2 = 0$ becomes $x^2 - 4x + 1 = 3$
- draw the line **y = 3** and read where it meets the curve

Exercise 3.3 (e)

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

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

Exercise 3.3 (e)

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

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

(e)

$$x = \frac{4 \pm \sqrt{16 + 8}}{2}$$

- $\sqrt{24} = 4.899$
- **x = 4.45** or **x = -0.45**