

Function graph investigation

Plot a quadratic, then read its story from the graph.



NAME _____ CLASS _____ DATE _____

LEARNING GOAL

I can draw the graph of a quadratic function and use it to describe the function's key features.

SUCCESS CRITERIA

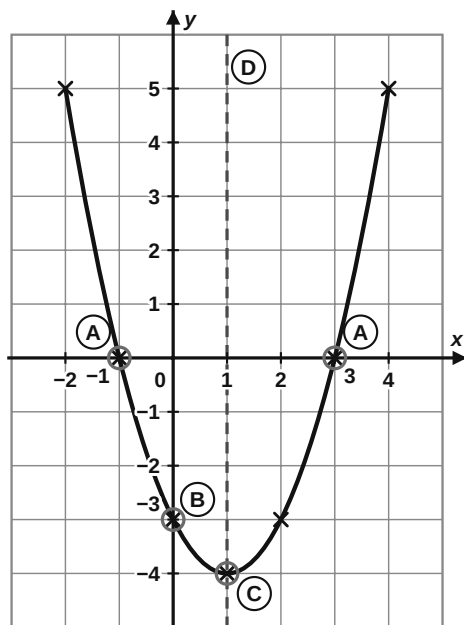
- ☐ I can square negatives correctly in a table of values.
- ☐ I can plot points and join them with one smooth curve.
- ☐ I can read roots, intercepts, turning point and range.
- ☐ I can link algebraic forms to features of the graph.

1 Worked example: build the table for $y = x^2 - 2x - 3$

Work out each row, then add down the column to get y. A negative squared is always positive.

x	-2	-1	0	1	2	3	4
x^2	4	1	0	1	4	9	16
$-2x$	4	2	0	-2	-4	-6	-8
-3	-3	-3	-3	-3	-3	-3	-3
y	5	0	-3	-4	-3	0	5

2 Plot the points, then read the features



A **ROOTS**
 $x = -1$ and $x = 3$
The curve meets the x-axis.

B **Y-INTERCEPT**
 $(0, -3)$
At $x = 0$, y is the constant.

C **TURNING POINT**
 $(1, -4)$, minimum
The lowest point of the curve.

D **LINE OF SYMMETRY**
 $x = 1$
 $x = -2$ and $x = 4$ both give 5.

R **RANGE**
 $y \geq -4$
Nothing lies below it.

E **DOMAIN, ASYMPTOTES**
All real x; none
It never levels off.

ONE FUNCTION, THREE FORMS

$$x^2 - 2x - 3 = (x + 1)(x - 3) = (x - 1)^2 - 4$$

Factorised shows the roots: a bracket is 0 when $x = -1$ or $x = 3$.

Completed square shows the turning point: $(x - 1)^2$ is smallest, 0, at $x = 1$.

1 square = 1 unit on both axes. Plot each point as a small cross, then draw **one smooth curve** through them all: rounded at the bottom, never pointed or flat.

Investigate $y = x^2 + 2x - 8$ **1 Complete the table of values** Fill each row, then add down the columns, as on page 1.

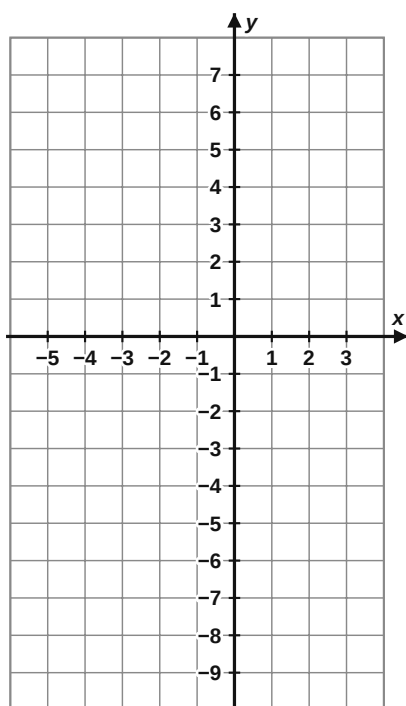
4 marks

x	-5	-4	-3	-2	-1	0	1	2	3
x^2									
$+2x$									
-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
y									

2 Draw the graph

Plot, join, label A to D.

3 marks

**3 Read the features**

7 marks

A ROOTS $x = \underline{\hspace{2cm}}$ and $x = \underline{\hspace{2cm}}$ **B** Y-INTERCEPT $(0, \underline{\hspace{2cm}})$ **C** TURNING POINT $(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ **D** LINE OF SYMMETRY $x = \underline{\hspace{2cm}}$ Check: $(\underline{\hspace{1cm}} + \underline{\hspace{1cm}}) \div 2 = \underline{\hspace{2cm}}$ **R** RANGE $\underline{\hspace{4cm}}$ **E** DOMAIN, ASYMPTOTES Domain: $\underline{\hspace{4cm}}$ Asymptotes?

Explain: why is the y-intercept always the constant term of a quadratic?

4 Connect the forms

4 marks

$$x^2 + 2x - 8 = (x + \boxed{\hspace{1cm}})(x - \boxed{\hspace{1cm}})$$

This form shows the $\underline{\hspace{4cm}}$

$$x^2 + 2x - 8 = (x + \boxed{\hspace{1cm}})^2 - \boxed{\hspace{1cm}}$$

This form shows the $\underline{\hspace{4cm}}$ Check by expanding: do you get $x^2 + 2x - 8$ back?

GO FURTHER

What changes for $y = -x^2 + 4$? Plot it on your grid for $-3 \leq x \leq 3$ with a dashed curve. Name two features that change and one that stays the same.
