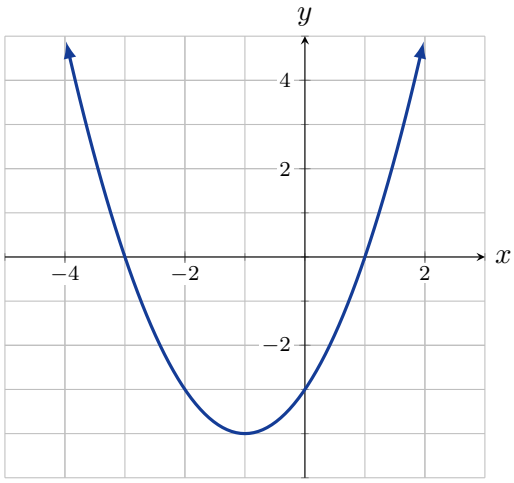
Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Extension A is double width. Cut along the frames. Cards 1 to 9 are the sequence; Extensions A and B are for groups that finish early.

Card 1



This is the graph of $y = (x - 1)(x + 3)$.

At which points is $y = 0$? How does the graph show you?

Card 2

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

Here is a table for the same relation, $y = (x - 1)(x + 3)$. Find the three missing rows on your board.

Which rows match the points from Card 1? Apart from $y = 0$, what else do those two rows have in common?

Card 3

On the x-axis, $y = 0$. Put $y = 0$ into the equation:

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

Here the two brackets multiply to make 0. When two numbers multiply to make 0, what must be true of one of them?

Use that to find the x-values. Use no graph and no table.

Card 4

The **zeros** of a relation are the x-values where $y = 0$.

$$y = 2(x - 4)(x + 5)$$

Find the zeros. Use no graph and no table.

Does the a value, 2, change the values of the zeros?

Task Cards — Backs

Answers for the cards on the other side of this sheet.

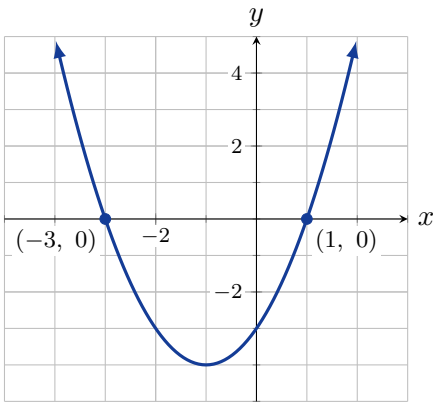
Card 2 — answer

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

The rows $x = -3$ and $x = 1$ are the points $(-3,\ 0)$ and $(1,\ 0)$. In each of those rows one bracket is 0, and 0 times any number is 0, so y is 0.

The x-values where $y = 0$ are called the **zeros** of the relation.

Card 1 — answer



$y = 0$ at $(-3,\ 0)$ and $(1,\ 0)$.

Every point on the x-axis has $y = 0$, so $y = 0$ where the graph crosses the x-axis.

Card 4 — answer

$0 = 2(x-4)(x+5)$

2 is never 0, so one bracket must be 0:

$$x - 4 = 0 \quad \text{or} \quad x + 5 = 0$$
$$x = 4 \qquad\qquad x = -5$$

The zeros are 4 and -5.

No. $y = (x-4)(x+5)$ has the same zeros. The a value multiplies every y-value (a vertical stretch by a factor of 2), and $2 \times 0 = 0$, so the points on the x-axis stay where they are.

Card 3 — answer

If neither number is 0, the product is not 0: for example, $2 \times 3 = 6$ and $(-1)(4) = -4$. So when a product is 0, one of the numbers must be 0.

Here the numbers are the two brackets, so one bracket must be 0:

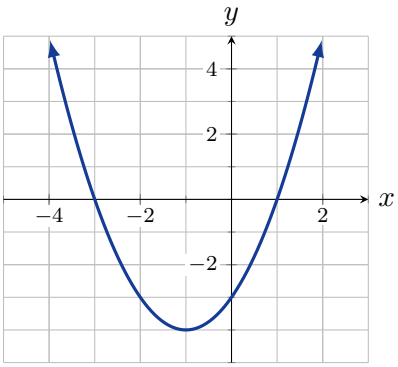
$$x - 1 = 0 \quad \text{or} \quad x + 3 = 0$$
$$x = 1 \qquad\qquad x = -3$$

These match the graph on Card 1 and the table on Card 2.

Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Extension A is double width. Cut along the frames. Cards 1 to 9 are the sequence; Extensions A and B are for groups that finish early.

Card 5



This is the graph from Card 1, $y = (x - 1)(x + 3)$. Where is the vertex, compared with the two zeros?

Find the vertex of

$$y = (x - 5)(x + 1).$$

Use no table.

Card 6

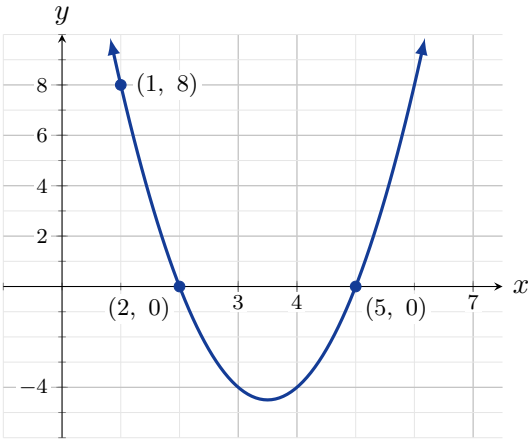
You have only the equation:

$$y = -(x + 7)(x + 1)$$

Sketch the parabola on a grid. Use no table.

Check your sketch with one more point.

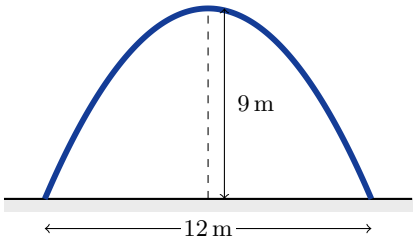
Card 7



This parabola crosses the x-axis at the two marked points. One more point is marked.

Write its equation with two brackets.

Card 8



A gate is an opening in a wall. This gate has the shape of a parabolic arch. It is 12 m wide at the ground and 9 m tall at its centre.

Put the ground on the x-axis and the left end of the arch at the origin. Write an equation for the arch.

Task Cards — Backs

Answers for the cards on the other side of this sheet.

Card 6 — answer

Zeros -7 and -1, so plot $(-7,\ 0)$ and $(-1,\ 0)$.

Axis of symmetry: $x = \frac{-7+(-1)}{2} = -4$.

Vertex:
$y = -(-4+7)(-4+1) = -(3)(-3) = 9$, so $(-4,\ 9)$.

The minus sign in front ($a = -1$) reflects the graph in the x-axis: it opens **downward**, and $(-4,\ 9)$ is a maximum.

Check: $x = -2$ gives $-(5)(-1) = 5$, so $(-2,\ 5)$. Its partner across the axis is $(-6,\ 5)$.

Card 5 — answer

The vertex $(-1,\ -4)$ is straight below the point **midway** between the two crossing points: its x-value is midway between the zeros -3 and 1, $\frac{-3+1}{2} = -1$.

$y = (x-5)(x+1)$: zeros 5 and -1; midway is $\frac{5+(-1)}{2} = 2$.

$y = (2-5)(2+1) = (-3)(3) = -9$. Vertex $(2,\ -9)$.

A parabola is symmetric about its axis, and the two points where the graph crosses the x-axis are both at height 0, so the axis passes halfway between them.

Card 8 — answer

The two points where the arch meets the ground are on the x-axis, where $y = 0$, so their x-values, 0 and 12, are the zeros: $y = a(x-0)(x-12) = ax(x-12)$.

The top is midway between those two points, because the arch is symmetric (Card 5), at $(6,\ 9)$: $9 = a(6)(6-12) = -36a$, so $a = -\frac{1}{4}$.

$y = -\frac{1}{4}x(x-12)$

Card 7 — answer

$x-2$ is 0 when $x = 2$, and $x-5$ is 0 when $x = 5$, so $y = (x-2)(x-5)$ is 0 at both marked points. Any a value keeps those zeros (Card 4), so write $y = a(x-2)(x-5)$ and use the third point to find a.

Substitute $(1,\ 8)$: $8 = a(1-2)(1-5) = 4a$, so $a = 2$.

$y = 2(x-2)(x-5)$

Check the partner point $(6,\ 8)$: $2(4)(1) = 8$. It fits.

This is the **intercepts form**, $y = a(x-r)(x-s)$: r and s are the zeros.

Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Extension A is double width. Cut along the frames. Cards 1 to 9 are the sequence; Extensions A and B are for groups that finish early.

Card 9

x	y
0	0
1	5
2	8
3	9
4	8
5	5
6	0

The table shows points on a parabola.

Write its equation in vertex form.

Then write its equation in intercepts form (the form with two brackets).

Check: both equations give the same y when $x = 1$.

Extension B

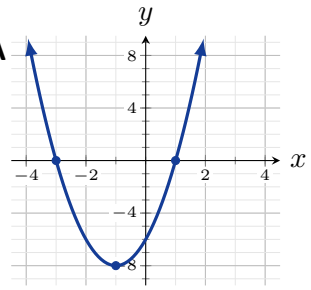
For groups that finish early.

Think of a parabola that touches the x-axis at only one point. Then think of one that never meets the x-axis.

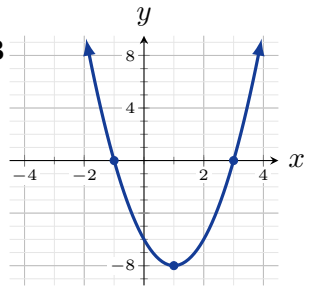
What happens to the two brackets for each one?

Extension A

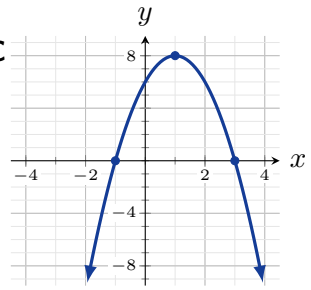
A



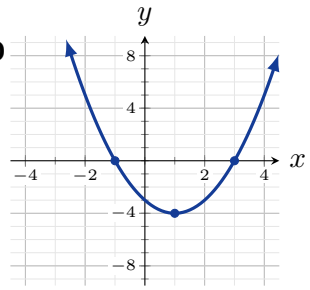
B



C



D



For groups that finish early.

Which of these graphs is

$$y = 2(x + 1)(x - 3)?$$

Show that your choice is correct.

Task Cards — Backs

Answers for the cards on the other side of this sheet.

Extension B — answer

One point: the vertex sits on the x-axis, so both zeros are the same number. The two brackets are the same: $y = (x-2)(x-2) = (x-2)^2$ touches at $(2,\ 0)$.

Never meets the x-axis: there are no zeros, so there is nothing to put in the brackets. For example, $y = (x-2)^2 + 1$ has its lowest point at height 1. It cannot be written in intercepts form.

Card 9 — answer

Vertex form: the y-values pair up around $x = 3$, so the vertex is $(3,\ 9)$. The steps from the vertex are 1, then 3, downward, so $a = -1$: $y = -(x-3)^2 + 9$.

Intercepts form: the zeros are 0 and 6, so $y = ax(x-6)$. Substitute $(3,\ 9)$: $9 = a(3)(-3) = -9a$, so $a = -1$: $y = -x(x-6)$.

Check $x = 1$: $-(1-3)^2 + 9 = -4 + 9 = 5$ and $-(1)(1-6) = 5$. Both match the table.

Extension A — answer

B.

Zeros: $0 = 2(x+1)(x-3)$ when $x + 1 = 0$ or $x - 3 = 0$, so the zeros are -1 and 3. B crosses the x-axis at -1 and 3.

Direction: $a = 2$ is positive, so the parabola opens upward. B opens upward.

Vertex: midway between the zeros, at $x = \frac{-1+3}{2} = 1$, and $y = 2(1+1)(1-3) = 2(2)(-2) = -8$. B's vertex is $(1,\ -8)$.