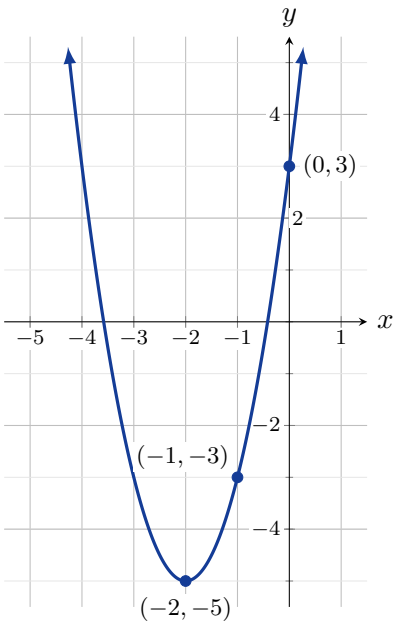
Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Cards 1 to 7 are the sequence; Extensions A and B are for groups that finish early. Cut along the frames.

Card 1



This parabola is narrower than $y = x^2$.

Find a. Then write its equation.

Check: substitute one of the marked points.

Card 2

Two students compare $y = 4x^2$ with $y = x^2$.

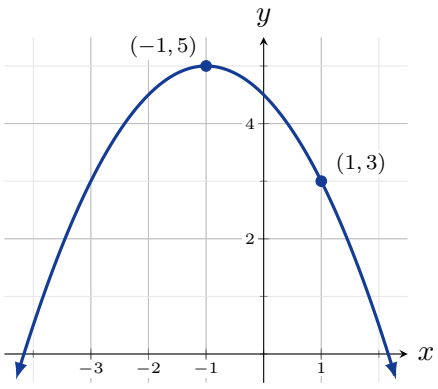
One says: "It is stretched vertically by a factor of 4."

The other says: "It is squeezed toward the y-axis."

x	x^2	$4x^2$
-2	4	16
-1	1	4
0	0	0
1	1	4
2	4	16

Who is right? Why is the first description the usual one?

Card 3



This parabola opens downward. One step from its vertex does not land on a grid corner.

Substitute the marked point to find a. Then write the equation.

Task Cards — Backs

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

Card 1 — answer

From the vertex $(-2,\ -5)$: 1 right goes up 2 to $(-1,\ -3)$, then 1 more right goes up 6 to $(0,\ 3)$.

The step pattern is $1a$, $3a$, so $1a = 2$ and $a = 2$.

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

Check $(0,\ 3)$: $2(0 + 2)^2 - 5 = 8 - 5 = 3$.

Card 3 — answer

The vertex gives $y = a(x + 1)^2 + 5$. Put in $(1,\ 3)$:
$3 = a(1 + 1)^2 + 5$
$3 = 4a + 5$
$-2 = 4a$, so $a = -\frac{1}{2}$.

$y = -\frac{1}{2}(x + 1)^2 + 5$

One step from the vertex goes down $\frac{1}{2}$, between grid lines, so that height cannot be read exactly. Substitution works with any point.

Card 2 — answer

Both are right. Each value in the $4x^2$ column is 4 times the value beside it, so every point is 4 times as high. And $y = 4x^2$ reaches 4 at $x = 1$, where $y = x^2$ needs $x = 2$, so the graph is also squeezed to half its width.

We use the vertical description because a multiplies every y-value, so the factor shows in the equation.

Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Cards 1 to 7 are the sequence; Extensions A and B are for groups that finish early. Cut along the frames.

Card 4

Nobody has drawn this parabola.

Its vertex is $(4,\ -1)$. It passes through $(2,\ 7)$.

Write its equation.

Card 5

Look at the parabola from Card 4.

Name one more point on the parabola.

Use no arithmetic. Think about the shape of a parabola.

Card 6

The vertical line through the vertex is called the **axis of symmetry**.

Why is that a good name for this line?

Use the two points from Card 5 in your answer.

Card 7

$$y = 2(x - 3)^2 - 5$$

Where does this parabola cross the y-axis?

Which other point on the parabola is at the same height?

Task Cards — Backs

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

Card 5 — answer

A parabola is symmetrical: its left side is the mirror image of its right side, and the mirror line runs straight up and down through the vertex.

The vertex is $(4,\ -1)$, so the mirror line is at $x = 4$. The point $(2,\ 7)$ is 2 units left of that line, so its mirror image is 2 units right of the line, at the same height: $(6,\ 7)$.

To confirm: $2(6-4)^2 - 1 = 8 - 1 = 7$.

Card 4 — answer

The vertex gives $y = a(x-4)^2 - 1$. Put in $(2,\ 7)$:
$7 = a(2-4)^2 - 1$
$7 = 4a - 1$
$8 = 4a$, so $a = 2$.

$y = 2(x-4)^2 - 1$

Card 7 — answer

On the y-axis, $x = 0$:
$y = 2(0-3)^2 - 5 = 2(9) - 5 = 13$, so the point $(0,\ 13)$.

The equation of the axis of symmetry is $x = 3$. The point $(0,\ 13)$ is 3 units left of it, so its partner is 3 units right: $(6,\ 13)$.

Check: $2(6-3)^2 - 5 = 13$.

Card 6 — answer

The line $x = 4$ cuts the parabola into two halves that are mirror images. Fold the graph along the line and the halves match.

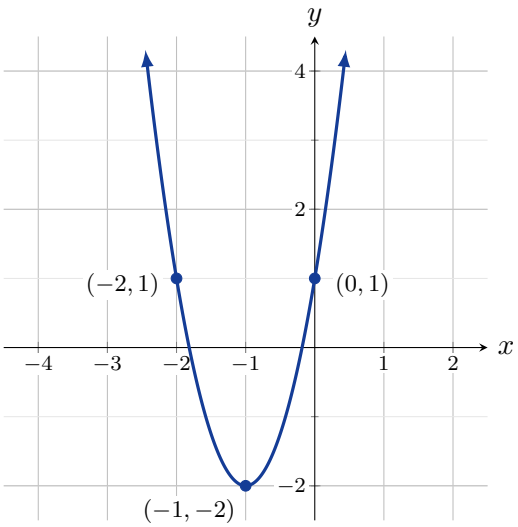
$(2,\ 7)$ and $(6,\ 7)$ are each 2 units from $x = 4$, one on each side, and they have the same height. Each one lands on the other when the graph is folded.

This always happens: two x-values the same distance from h make $(x-h)^2$ the same number, so they give the same y.

Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Cards 1 to 7 are the sequence; Extensions A and B are for groups that finish early. Cut along the frames.

Extension A



Which equation fits this graph?

A $y = 3(x-1)^2 - 2$

B $y = (x+1)^2 - 2$

C $y = 3(x+1)^2 - 2$

D $y = -3(x+1)^2 - 2$

Show that your choice is correct.

Extension B

x	y
-1	8
0	-1
1	-4
2	-1
3	8

The table shows some points on a parabola.

Write its equation.

Task Cards — Backs

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

Extension A — answer

C, $y = 3(x+1)^2 - 2$.

The vertex on the graph is $(-1,\ -2)$, so $h = -1$ and $k = -2$: $y = a(x+1)^2 - 2$.

One step right of the vertex, the graph goes up 3, to $(0,\ 1)$, so $a = 3$.

That gives $y = 3(x+1)^2 - 2$, which is **C**.

Check the other marked point, $(-2,\ 1)$: $3(-2+1)^2 - 2 = 3 - 2 = 1$.

Extension B — answer

The rows $x = 0$ and $x = 2$ both give -1, and the rows $x = -1$ and $x = 3$ both give 8, so the axis of symmetry is $x = 1$ and the vertex is $(1,\ -4)$.

From the vertex row, 1 step goes up 3 (to -1), the next goes up 9 (to 8): $1a = 3$, so $a = 3$.

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

Check $x = 3$: $3(3-1)^2 - 4 = 12 - 4 = 8$.