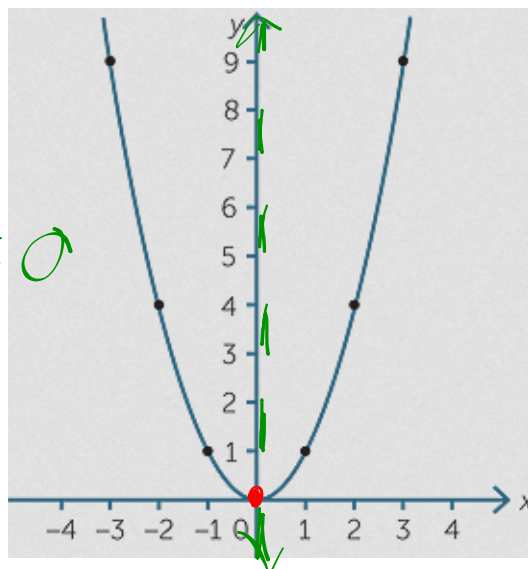## WARM UP

Find the following information about the given graph of the quadratic function $y = x^2$:

1. vertex: $(0, 0)$

2. axis of symmetry: $x = 0$

3. opens (up) or down?:

QUADRATIC
TRANSFORMATIONS

Clear Learning Targets

You will be able to describe the relationship between a transformed quadratic function and its parent function.

You will be able to apply transformations to quadratic functions.

Words Worth Knowing!

transformation - a movement of a geometric figure

translation - a transformation where a figure is slid from one position to another without being turned

dilation - a transformation that alters the size of a figure but not its shape

reflection - a transformation where a curve is flipped across a line (axis of symmetry)

Parent Function

All quadratic transformations stem from the same function, $f(x) = x^2.$ This is called the **parent function**.

By making specific changes to this function, we can create specific transformations!

$$f(x) = x^2 + k$$

What does it do?	How does it work?	What is it called?
shift/ slide up or down	• positive ↳ up "k" spaces • negative ↳ down "k" spaces	vertical translation

Example: What transformation is being applied in the following equation?

$$y = x^2 - 3$$

$$f(x) = (x - h)^2$$

What does it do?	How does it work?	What is it called?
shift/ slide left or right	• subtraction ↳ right "h" spaces • addition ↳ left "h" spaces	horizontal translation

Example: What transformation is being applied in the following equation?

$y = x^2 - 1$ **y = (x - 1)²**   • shifts right 1 space

$$f(x) = ax^2 \qquad f(x) = \frac{1}{\textcircled{5}}x^2$$

What does it do?	How does it work?	What is it called?
stretch or shrink	• a > 1 ↳ stretch by a factor of "a" • 0 < a < 1 ↳ shrink by a factor of	dilation "1/a"

Example: What transformation is being applied in the following equation?

y = 3x²

$$f(x) = -x^2$$

x	y		y
-2	4	→	-4
-1	1		-1
0	0		0
1			-1

What does it do?	How does it work?	What is it called?
flip over x-axis	change all y-values to opposites	vertical reflection

Example: What transformation is being applied in the following equation?

y = -x²

Combo Problems

We can use more than one transformation at a time.

Example: *f(x) = (x - 4)² + 3*

- Shift right 4
- Shift up 3

Example: *f(x) = -¼ x²*

- reflect over x-axis
- shrink by a factor of 4

EXIT TICKET

Take the parent function and write an equation that...

1) *moves it* **up** *2* $f(x) = x^2 + 2$

2) *moves it* **left** *2* $f(x) = (x + 2)^2$

3) **stretches** *it by a factor of 2* $f(x) = 2x^2$

4) **reflects** *it over the x-axis* $f(x) = -x^2$