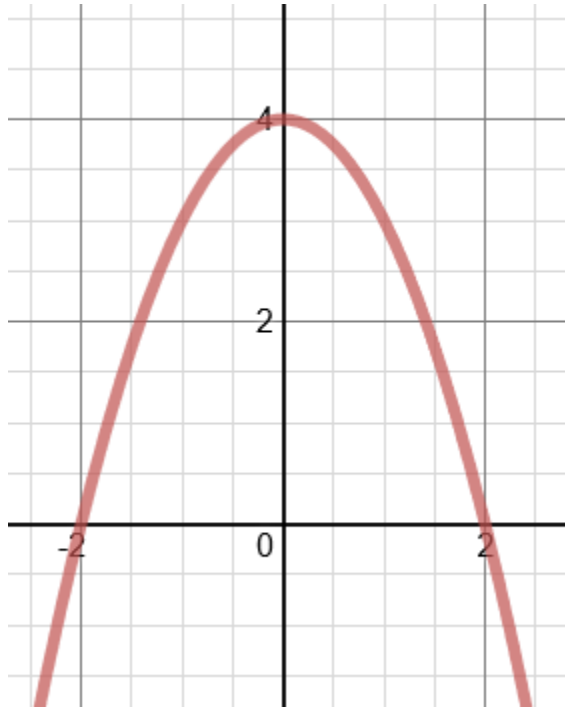**Warm -up**

Identify the parent function and list the transformations that have been applied.
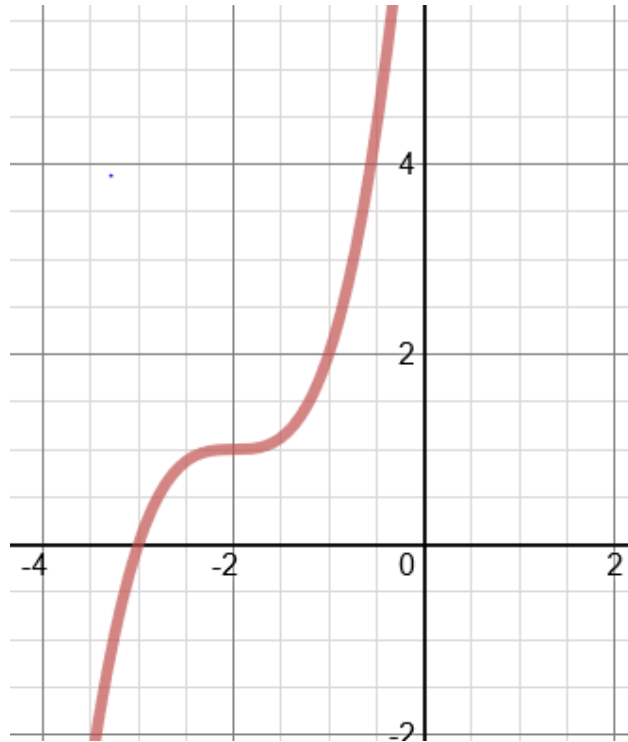

(0,5)

(1,2)

Parent Function:

Quadratic, $f(x) = x^2$

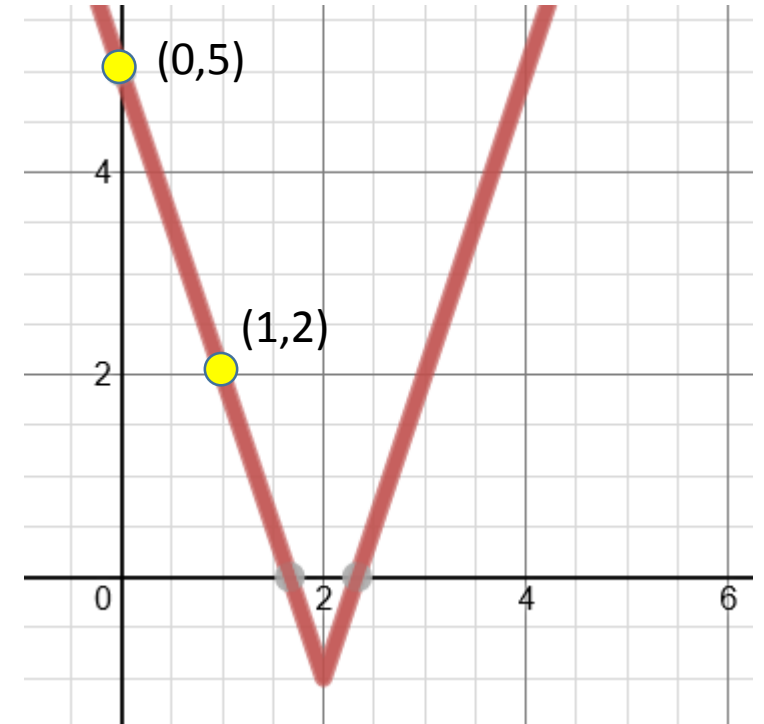Transformations:

Flipped over x axis

Vertical shift up 4

Parent Function:

Cubic, $f(x) = x^3$

Transformations:

Horizontal shift left 2

Vertical shift up 1

Parent Function:

Quadratic, $f(x) = |x|$

Transformations:

Right 2, Down 1

Vertical stretch by factor of ?

Objectives for today

Write a function equation from a description of transformations.

Apply transformations to functions that have already been transformed.

Determine the transformations that change one function to another function.

Homework

Finish the Transformations of Transformations worksheet

Transformations

Vertical Transformations

Function Notation	Description of Transformation
$g(x) = f(x) \pm c$	Vertical shift **up** C units if C is **positive**
	Vertical shift **down** C units if C is **negative**

Horizontal Translations

Function Notation	Description of Transformation
$g(x) = f(x \pm c)$	Horizontal shift **left** C units if C is **positive**.
	Horizontal shift **right** C units if C is negative

Reflections

Function Notation	Description of Transformation
$g(x) = -f(x)$	Reflected over the **x-axis**
$g(x) = f(-x)$	Reflected over the **y-axis**

Vertical Stretches and Compressions

Function Notation	Description of Transformation
$f(x) = cf(x)$	Vertical **Stretch** if $c > 1$
	Vertical **Compression** if $0 < c < 1$

	Parent Function	**Transformations**
$y = 3\lvert x \rvert + 1$	Absolute Value	Stretch factor 3, Up 1
$y = \dfrac{1}{2}\lvert x + 7 \rvert$	Absolute Value	Compression factor $\dfrac{1}{2}$ Left 7
$y = -5\sqrt{x - 7}$	Radical – Square Root	Flip, Stretch factor 5 Right 7
$y = -x^3 - 6$	Cubic	Flip, Down 6
$y = 2(x - 8)^2 - 6$	Quadratic	Stretch factor 2, Right 8, Down 6
$y = 0.5\sqrt{x + 5} + 42$	Radical	Compression Factor 0.5 Left 5, Up 42

Transformations

Transformations

OK, Let's get this quiz out of the way!

How do we transform a function that has already been transformed from the parent function?
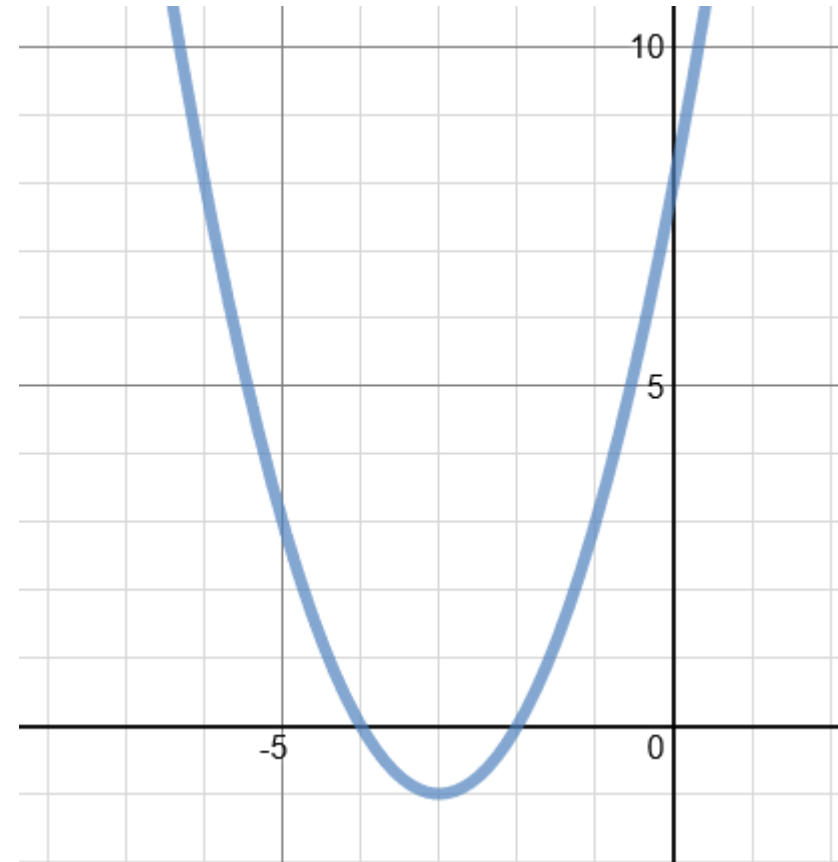
The function pictured is $f(x) = (x + 3)^2 - 1$

What would the equation be if the entire function is shifted up two units?

What part of the equation represents a vertical shift?

Add the number of units we want to shift the graph up to -1.

The resulting function is $g(x) = (x + 3)^2 + 1$

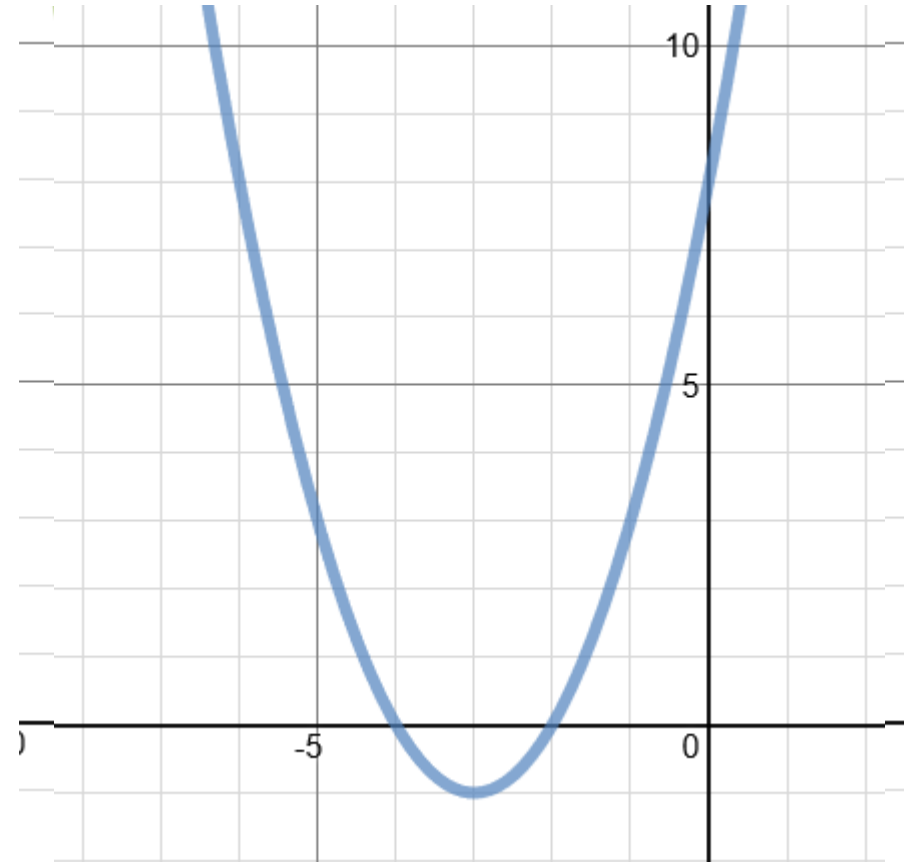# How do we transform a function that has already been transformed from the parent function?

The function pictured is $f(x) = (x + 3)^2 - 1$

What would the equation be if the entire function is shifted up left 3 units?

What part of the equation represents a horizontal shift?

Add the number of units we want to shift the graph left to 3.

The resulting function is $g(x) = (x + 6)^2 - 1$

Write the new function that would be created if the function $y = -4(x - 2)^2 + 5$ is flipped, stretched by a factor of 2 shifted left 1 unit and down 2?

First let's split up this equation.

Sign	First number	Inside	Outside
$-$	4	$(x - 2)^2$	$+5$
Flip	Stretch or Compression	Left or Right	Up or Down

Now apply new transformations to the corresponding parts

	Flip	Stretch by a factor of 2	Left 1	Down 2
	Change to $+$	Multiply by 2	Add 1	Subtract 2
New Parts	$+$	8	$(x - 1)^2$	$+3$

New Equation $y = 8(x - 1)^2 + 3$

Write the new function that would be created if the function $y = 4x^2 + 4$ is flipped, shifted right 3 unit and down 2?

Split up the equation.

Sign	First number	Inside	Outside
$+$	4	$(x + 0)^2$	$+4$
Flip	Stretch or Compression	Left or Right	Up or Down

Now apply new transformations to the corresponding parts

	Flip	No change	Right 3	Down 2
	Change to $-$	Same	Subtract 3	Subtract 2
New Parts	$-$	4	$(x - 3)^2$	$+2$

New Equation $\qquad y = -4(x - 3)^2 + 2$

Write the equation for the transformed function represented in this graph.

Parent Function?

Quadratic, $f(x) = x^2$

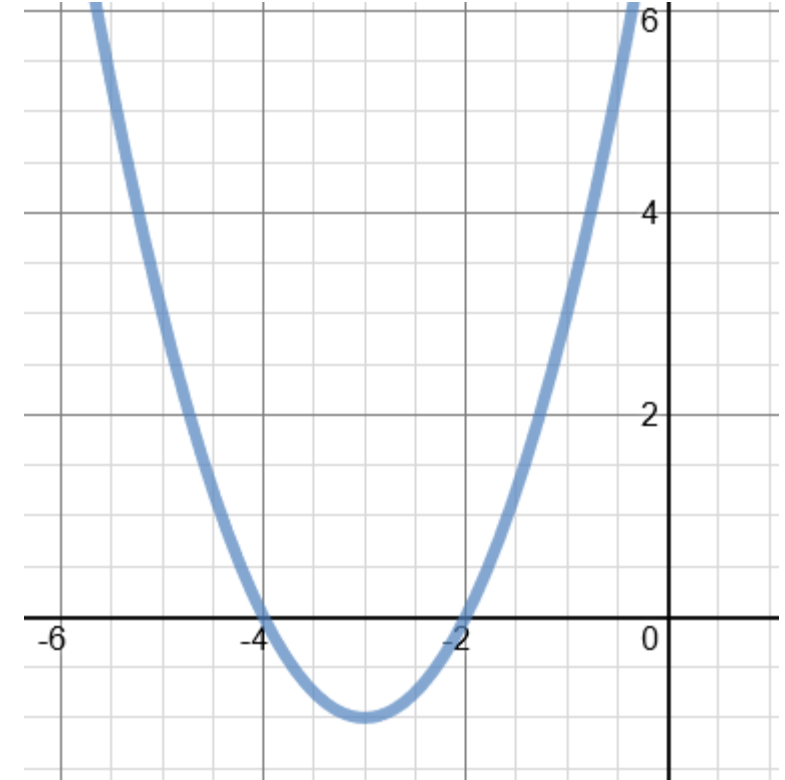**What do we know about the shape of the parent graph that can help us?**

U shape

Centered at (0,0)

$as\ x \to -\infty, y \to \infty$

$as\ x \to \infty, y \to \infty$

How is it different from the parent graph?

Horizontal shift left 3 units

Vertical shift down 1

Write an equation from what we know.

$g(x) = af(x - h) + k$

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

Write the equation for the transformed function represented in this graph.
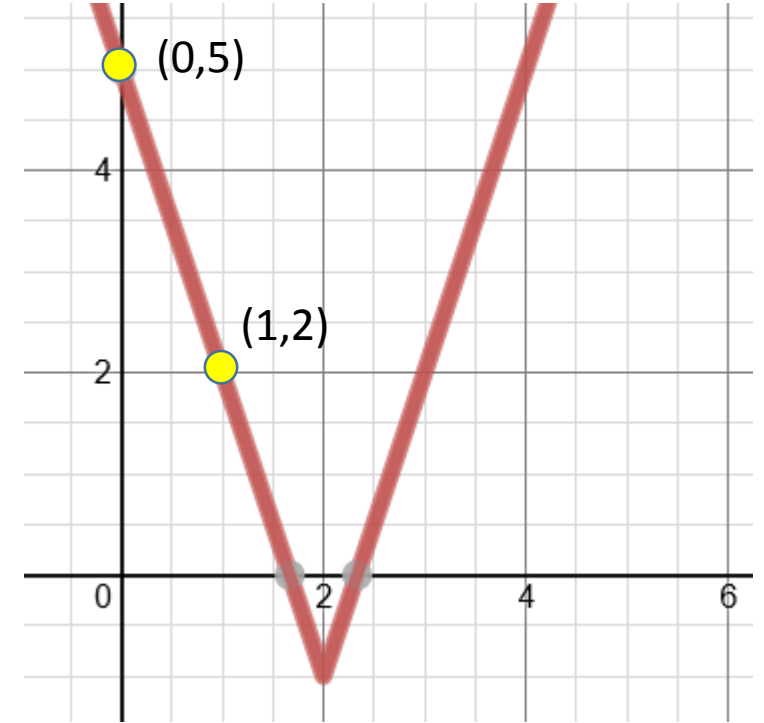
Parent Function?

Absolute Value, $f(x) = |x|$

What do we know about the shape of the parent graph that can help us?

V shape
Centered at (0,0)
$as\ x \to -\infty, y \to \infty$
$as\ x \to \infty, y \to \infty$

How is it different from the parent graph?

Horizontal shift right 2
Vertical Shift down 1
No Flip
Vertical stretch.

(0,5)

(1,2)

Write the equation for the transformed function represented in this graph.

Find a point on this graph.

$(0,5)$

Create an equation from what we know.

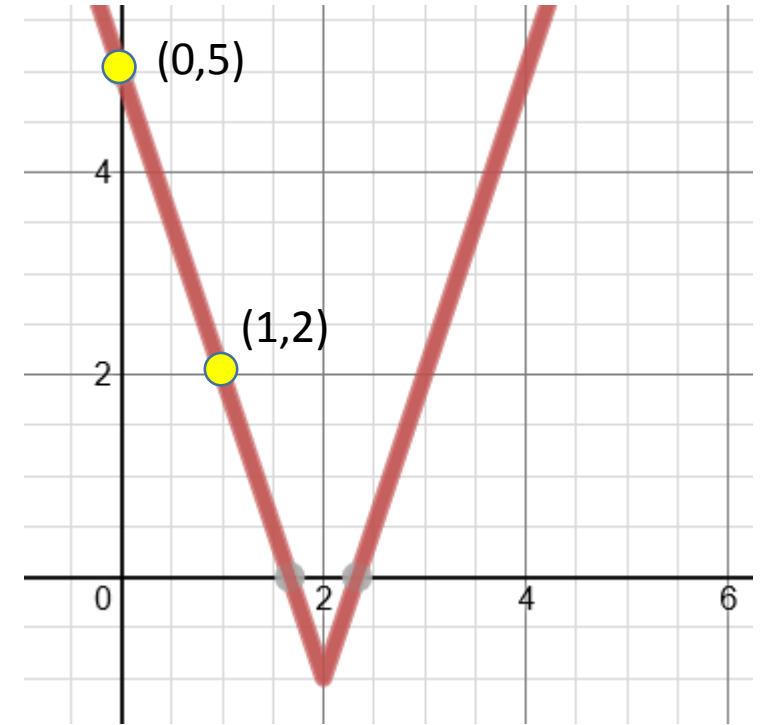$$g(x) = af(x - h) + k$$

$$g(x) = 5$$
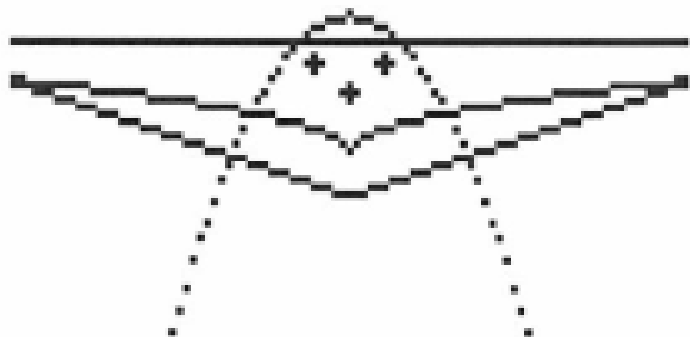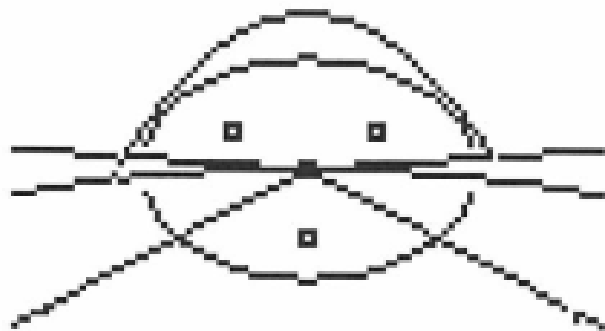$$x = 0$$
$$h = 2$$
$$k = -1$$

$$5 = a|0 - 2| - 1$$

Solve for the stretch factor.

$$3 = a$$

Write the equation of the function.

$$g(x) = 3|x - 2| - 1$$

(0,5)

(1,2)

I spy functions!

Transformations

Create graphs for functions that have been transformed and are in the form
$$g(x) = a \cdot f(x + h) - k$$

Interpret function equations that are in the above form and identify the transformations that have been applied to the parent function $f(x)$.

Describe the transformations that are applied to functions that have already been transformed from a parent function.