Warm -up

Identify the following:

Intervals

Increasing: $(-2, 1)$

Decreasing: $(-\infty, -2), (1, \infty)$

Constant: $None$

X Intercepts: $(-3, 0)$, $(0, 0)$, $(2, 0)$

Y Intercepts: $(0, 0)$

Relative Maximum(s): $(1, 4)$

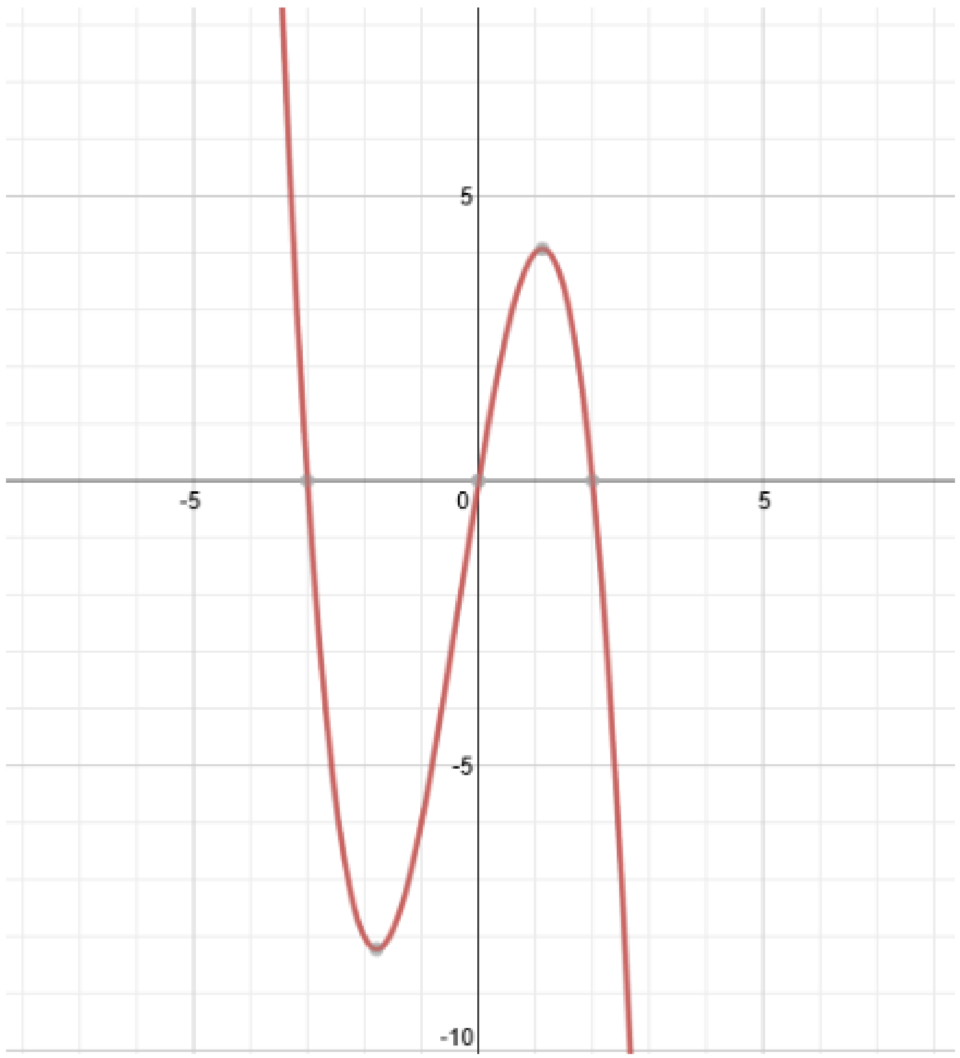
Relative Minimum(s): $(-1, -8)$

Domain: ***All Real Numbers***

Range: ***All Real Numbers***

End Behavior: $as\ x \rightarrow \infty, y \rightarrow -\infty$

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



Homework Questions?

Quiz TODAY

Pre-Assessment

Clear your desks

It’s Quiz Time!

You will not need a calculator.

10	10
9	9
8	8
7	7
6	6
5	5
4	4
3	3
2	2
1	1

Objectives for today

Identify function stretches and compressions from both a graph and an equation.

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 $f(x)$.

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

When a negative sign is found on the **outside** of the “f(x) part” the function is **flipped over the x-axis**.

When a negative sign is found on the **inside** of the “f(x) part” the function is **flipped over the y-axis**.

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

Reflections

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

What's the difference?

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

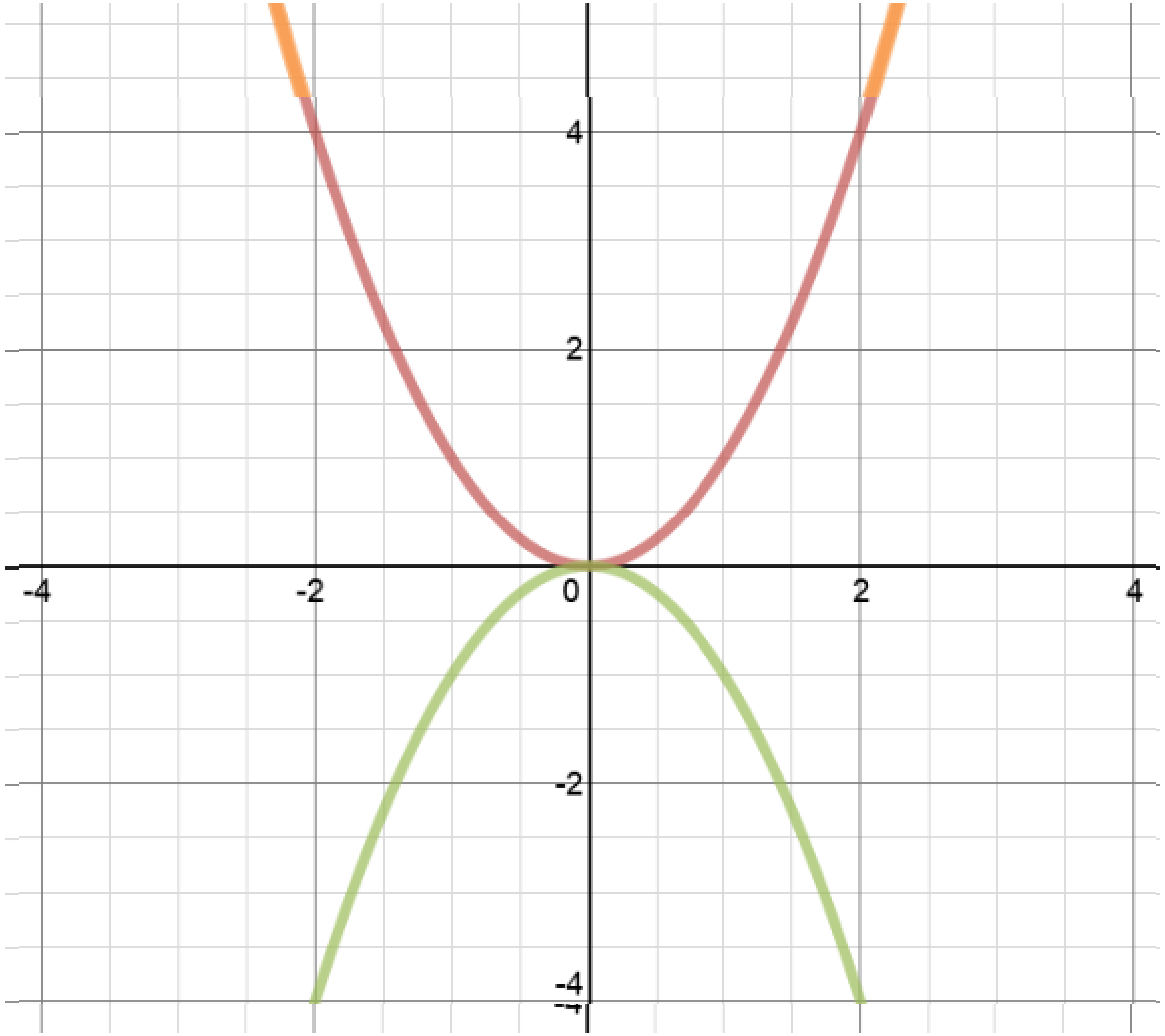
ORDER OF OPERATIONS		
P	Please	Parentheses
E	Excuse	Exponents
M	My	Multiplication
D	Dear	Division
A	Aunt	Addition
S	Sally	Subtraction

Transformations

Reflection across the x axis

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

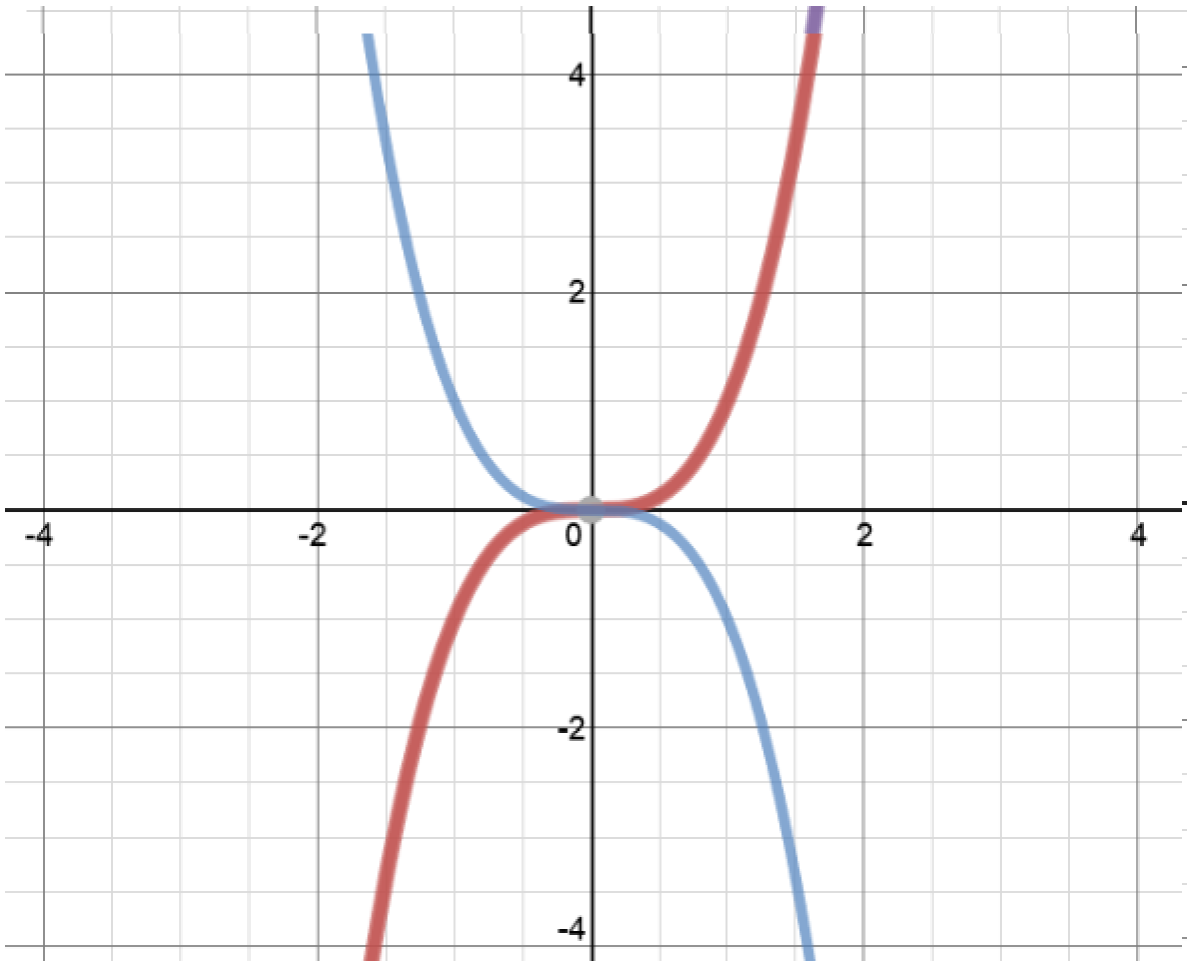
X	X^2	$-X^2$
3	9	-9
2	4	-4
1	1	-1
0	0	0
-1	1	-1
-2	4	-4
-3	9	-9



Reflection across the y axis

$$f(x) = (-x)^3$$

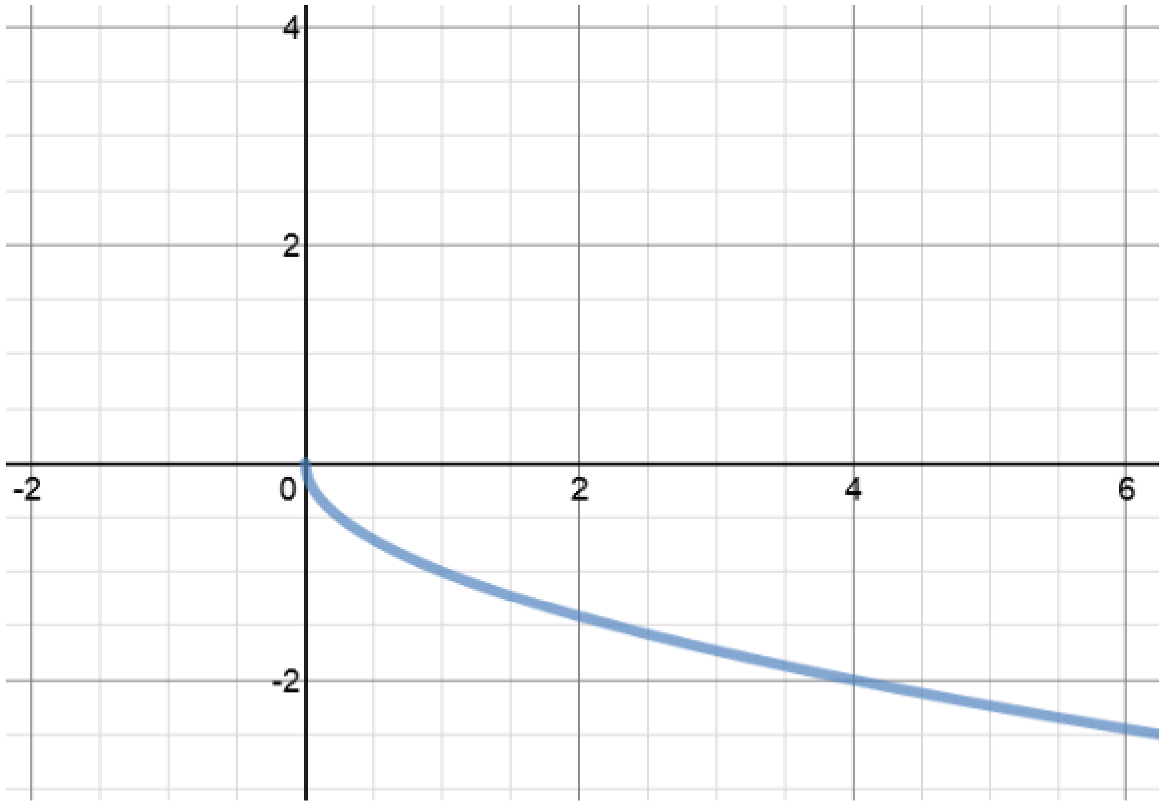
X	-X	$(-X)^3$
3	-3	-27
2	-2	-8
1	-1	-1
0	0	0
-1	1	1
-2	2	8
-3	3	27



Transformations

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

$f(x) = -\sqrt{x}$



Parent Function? **Radical, $f(x) = \sqrt{x}$**

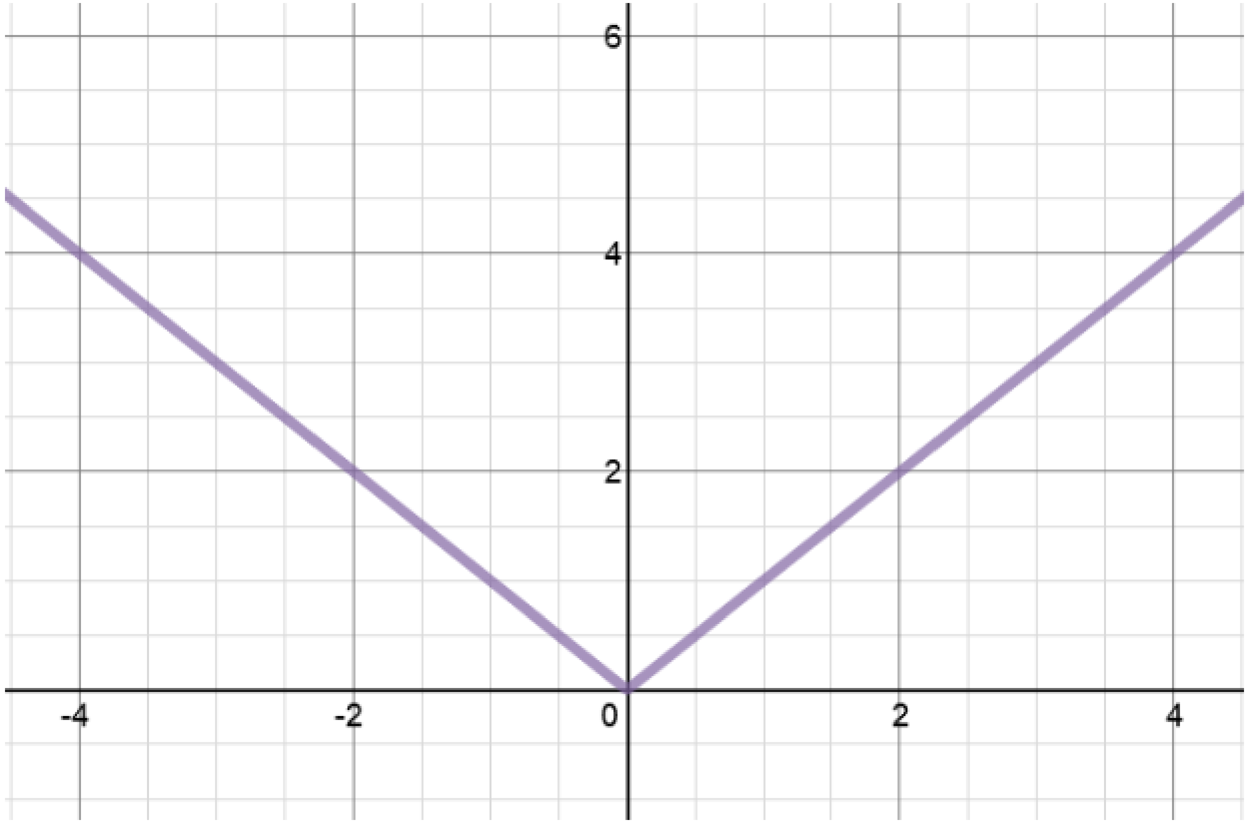
What do we know about the shape of the graph that can help us? **Starts at (0,0) and <u>increases</u>**

How is it different? **Starts at (0,0) and <u>decreases.</u>**

Which axis has it flipped over? **X-axis**

Transformations

Write two equations that could represent the function presented in this graph.



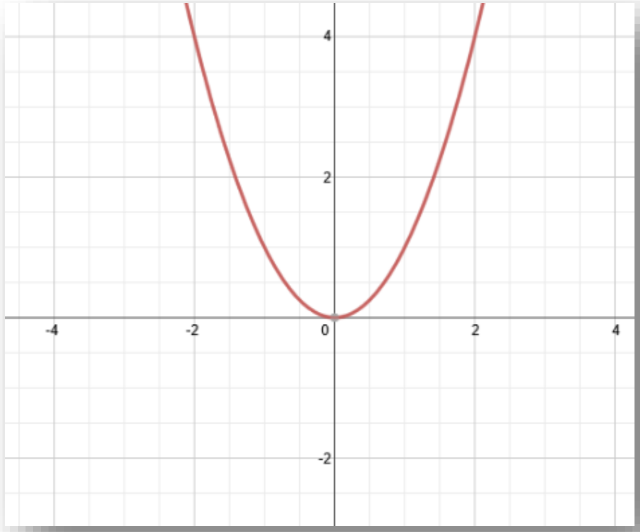
$$g(x) = |x|$$

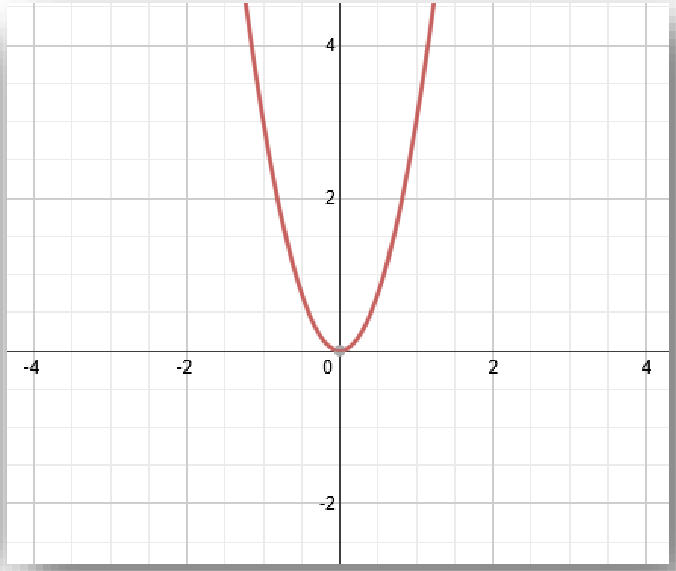
$$g(x) = |-x|$$

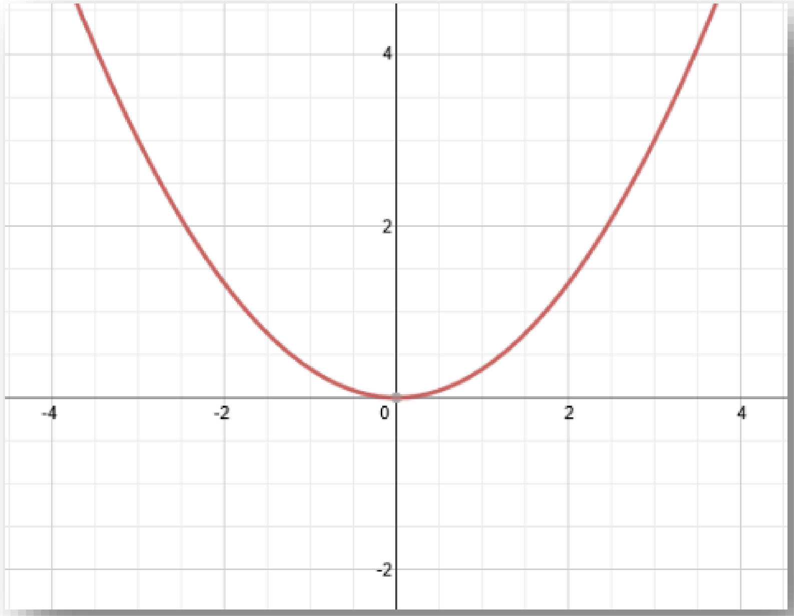
Now let's talk non-rigid…

Stretching and Compressing a function.

Stretching and Compressing a function.







Parent Function

Quadratic

$f(x)=x^2$

Transformed Function

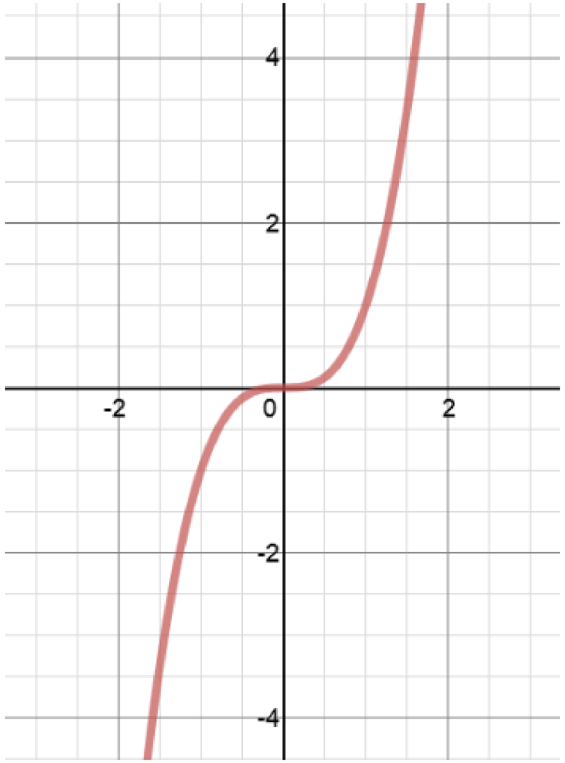
Vertical stretch

Transformed Function

Vertical compression

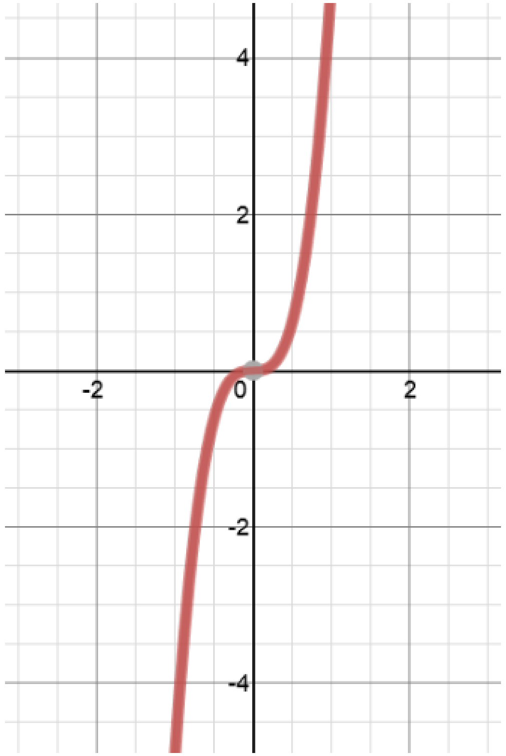
Transformations

Stretching and Compressing a function.



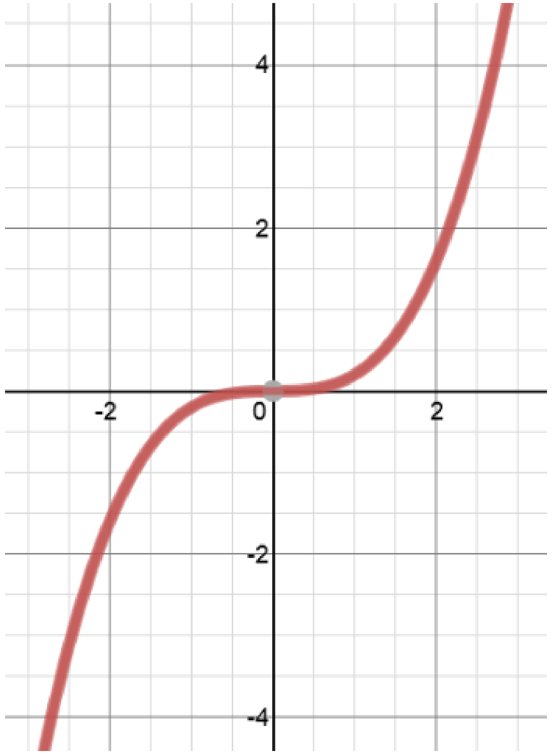
Parent Function

Quadratic
$f(x)=x^3$



Transformed Function

Vertical stretch



Transformed Function

Vertical compression

So how do we represent these transformations algebraically?

Vertical Stretches and Compressions

When functions are multiplied by a constant **outside** of the f(x) part, you stretch and compress the function.

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

Vertical Stretches and Compressions

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

How do we interpret this function notation?

Let $f(x) = x^2$ and $c = 3$ then $g(x) = 3x^3$

Let $f(x) = \sqrt{x}$ and $c = \frac{1}{4}$ then $g(x) = \frac{1}{4}\sqrt{x}$

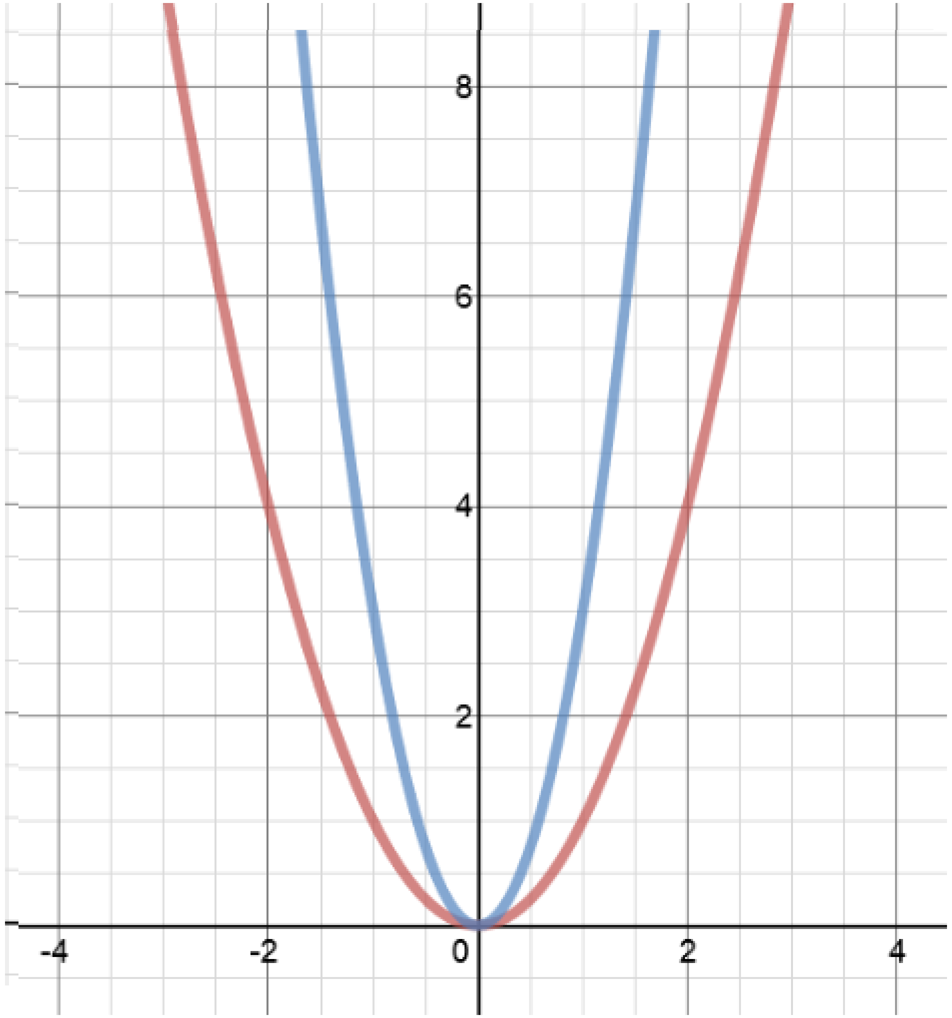
Let $f(x) = 2^x$ and $c = 7$ then $g(x) = 7(2^x)$

Transformations

Let's play **"What's going to happen to the parent function?"**

$$f(x) = 3x^2$$

X	X^2	$3X^2$
3	9	27
2	4	12
1	1	3
0	0	0
-1	1	3
-2	4	12
-3	9	27

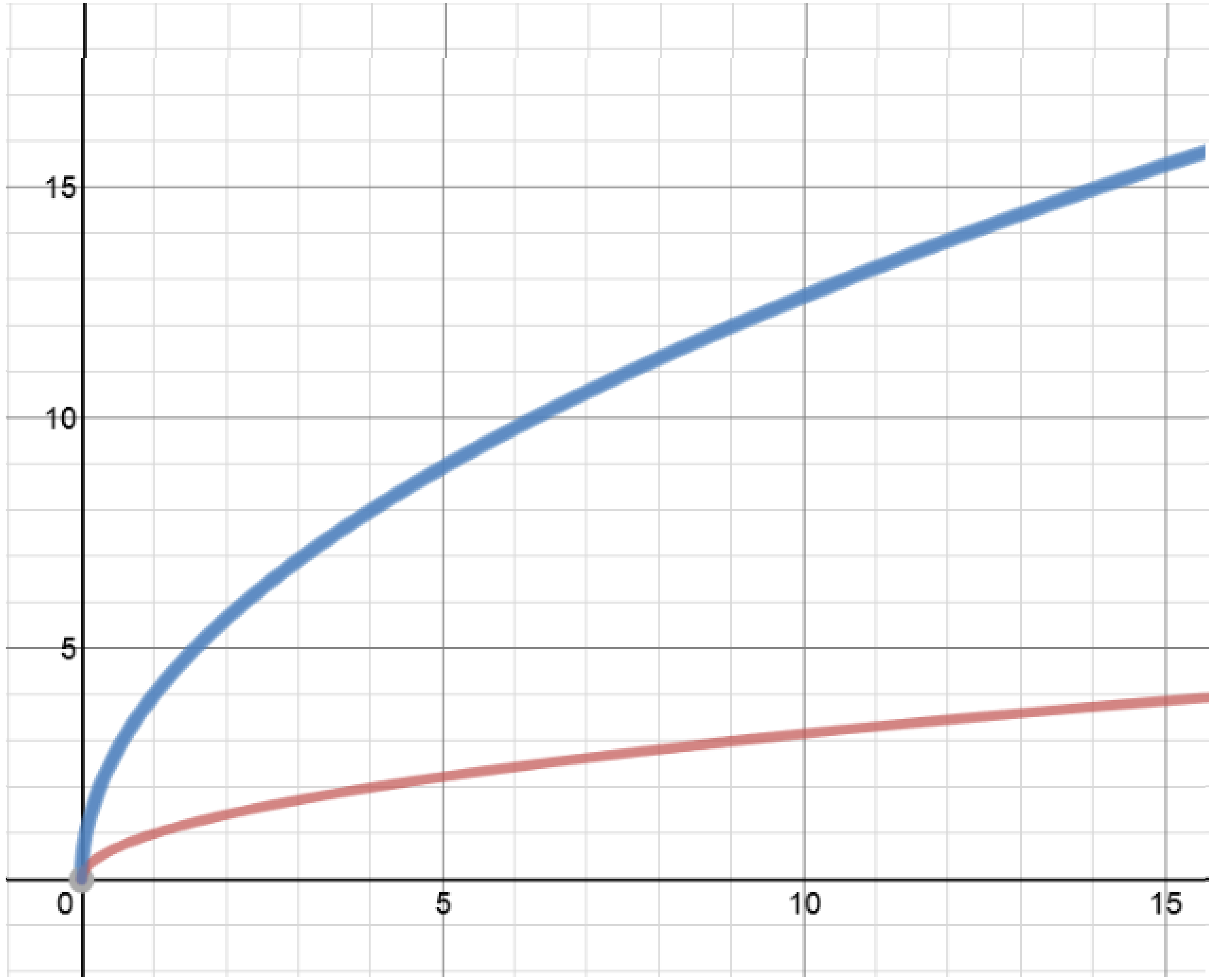


Transformations

Let's play **"What's going to happen to the parent function?"**

$$f(x) = 4\sqrt{x}$$

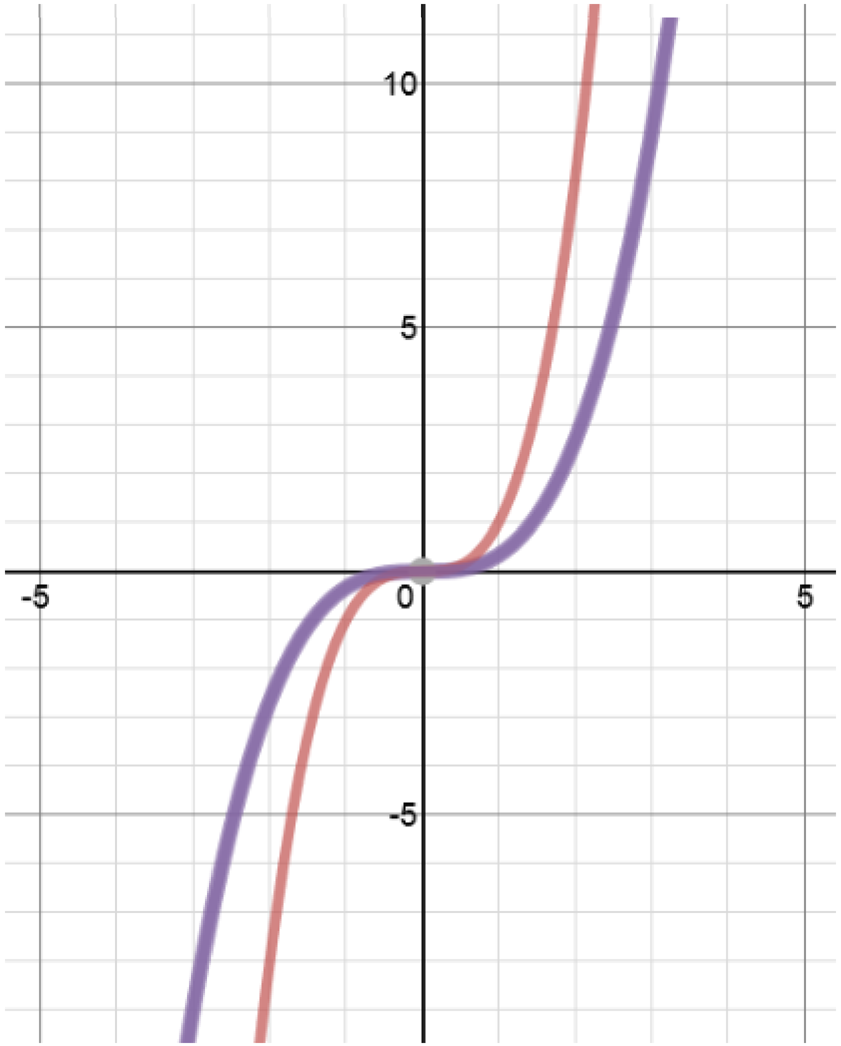
X	$\sqrt{x}$	$4\sqrt{x}$
9	3	12
4	2	8
1	1	4
0	0	0



Transformations

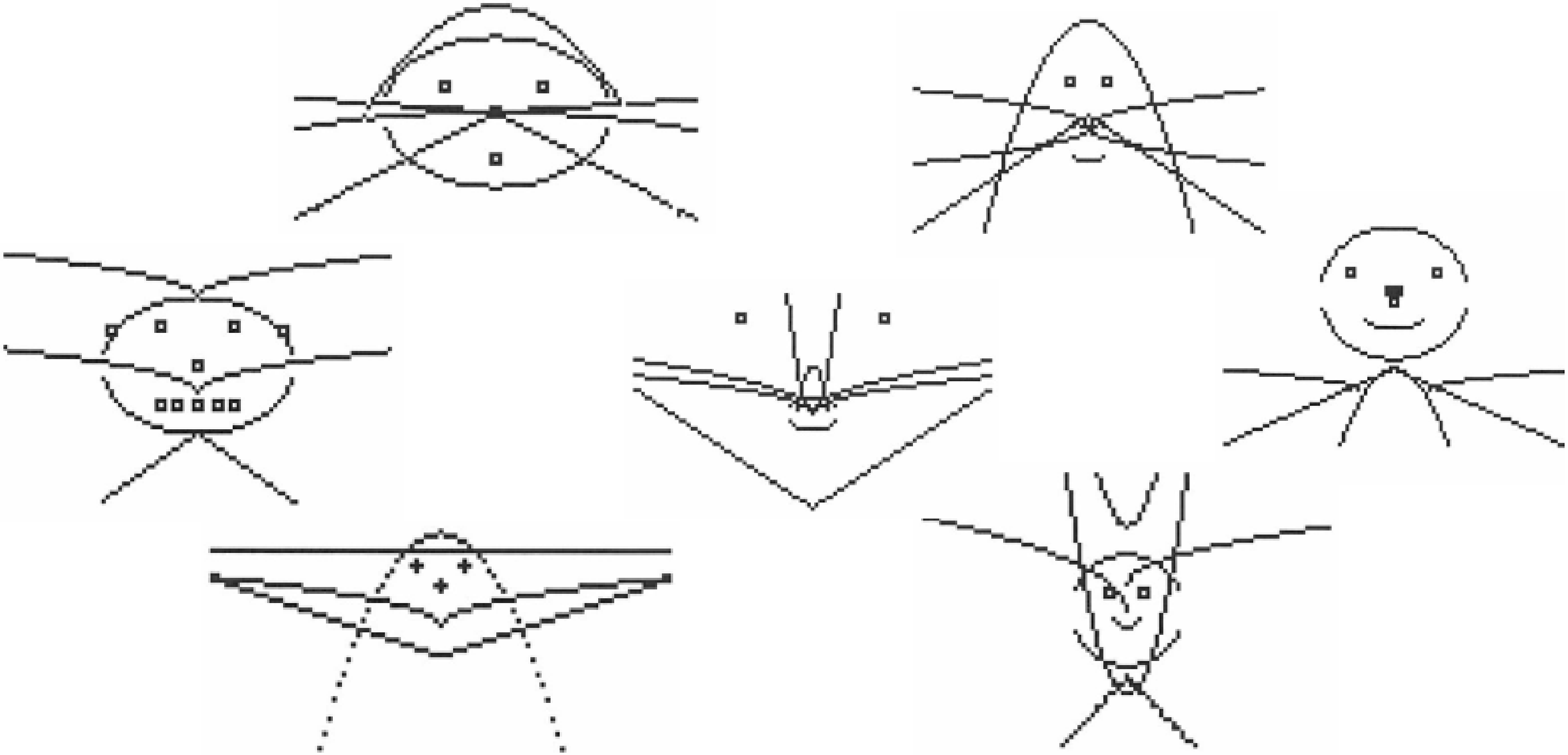
Let's play **"What's going to happen to the parent function?"**

$$f(x) = \frac{1}{3}x^3$$



Work with a partner to finish the transformations work sheet.

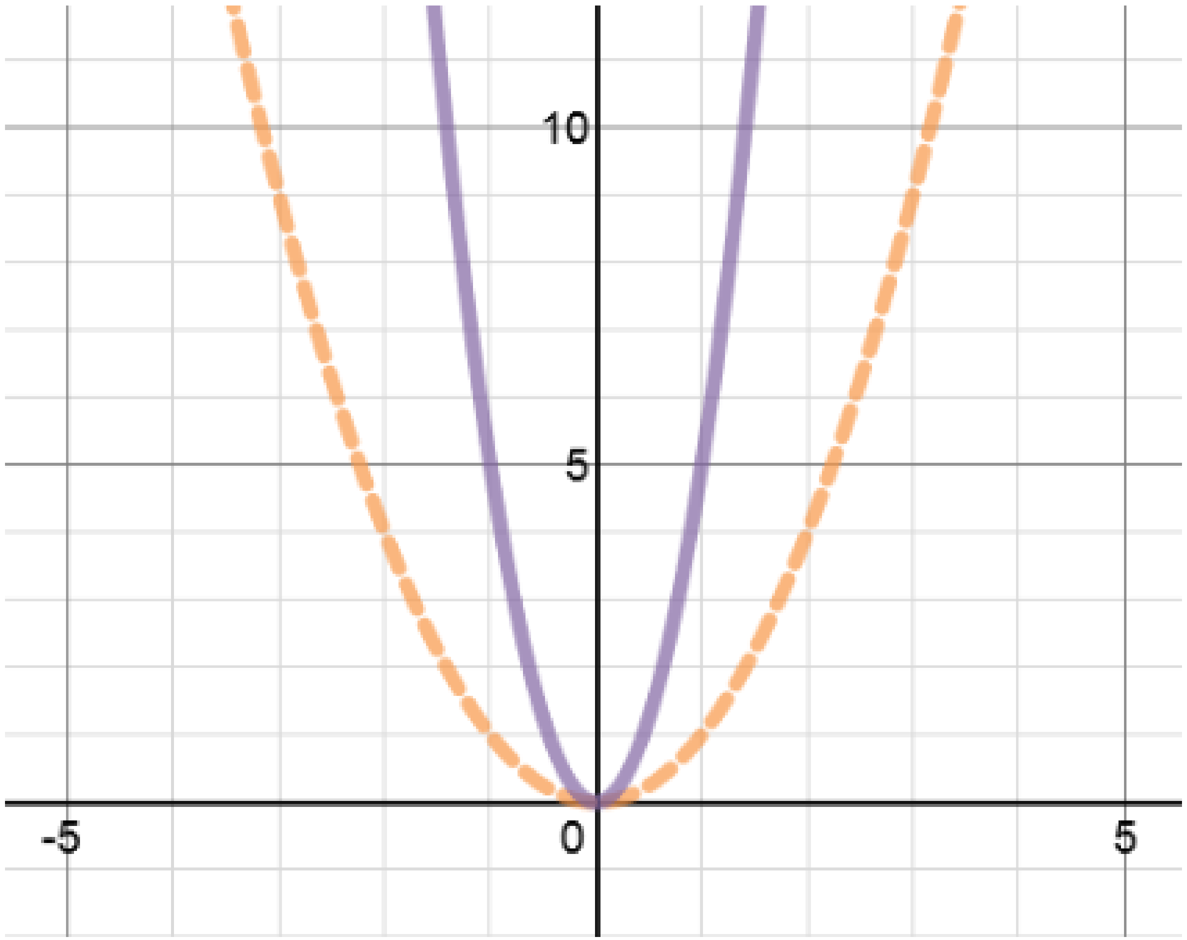
I spy functions!



Transformations

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

$g(x)=5x^2$



Parent Function? **Quadratic, $f(x)=x^2$**

What do we know about the shape of the graph that can help us? **Vertex at (0,0) and opens up.**

How is it different? **No vertical or horizontal shifts. No Flip.**

Find a point on this graph. **(1,5)**

Create an equation from what we know and solve for the stretch or compression factor.

$y = cx^2$

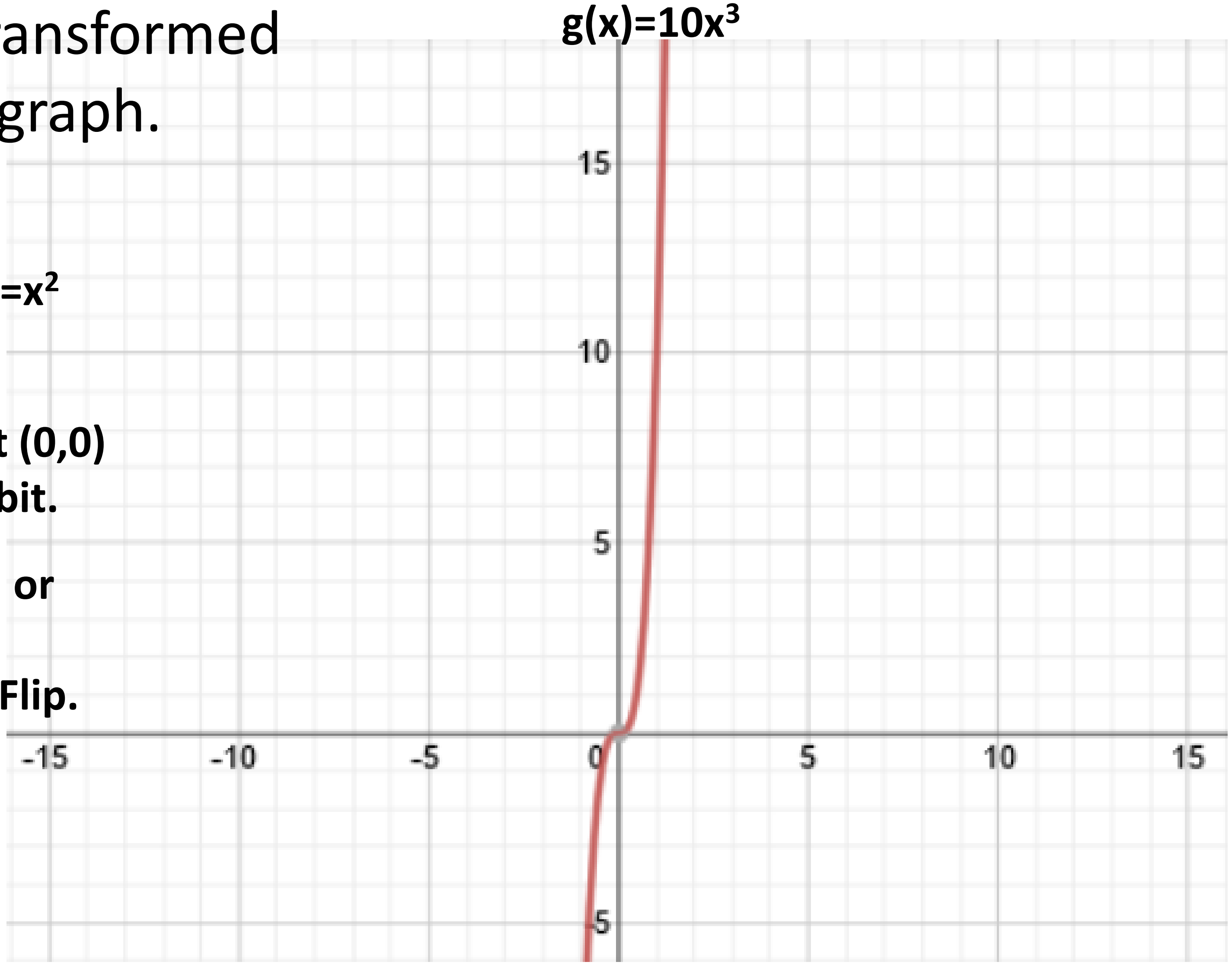
$5 = c1^2$

$5/1 = c$

$5= c$

Transformations

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



Parent Function? **Cubic, $f(x)=x^2$**

What do we know about the shape of the graph that can help us? **Increasing, centered at (0,0) with a flat bit.**

How is it different? **No vertical or horizontal shifts. No Flip.**

Find a point on this graph. **(1,10)**

Create an equation from what we know and solve for the stretch or compression factor.

$$y = cx^2$$
$$10 = c1^2$$
$$10/1 = c$$
$$10 = c$$

Transformations

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

Parent Function? **Linear, f(x)=x**

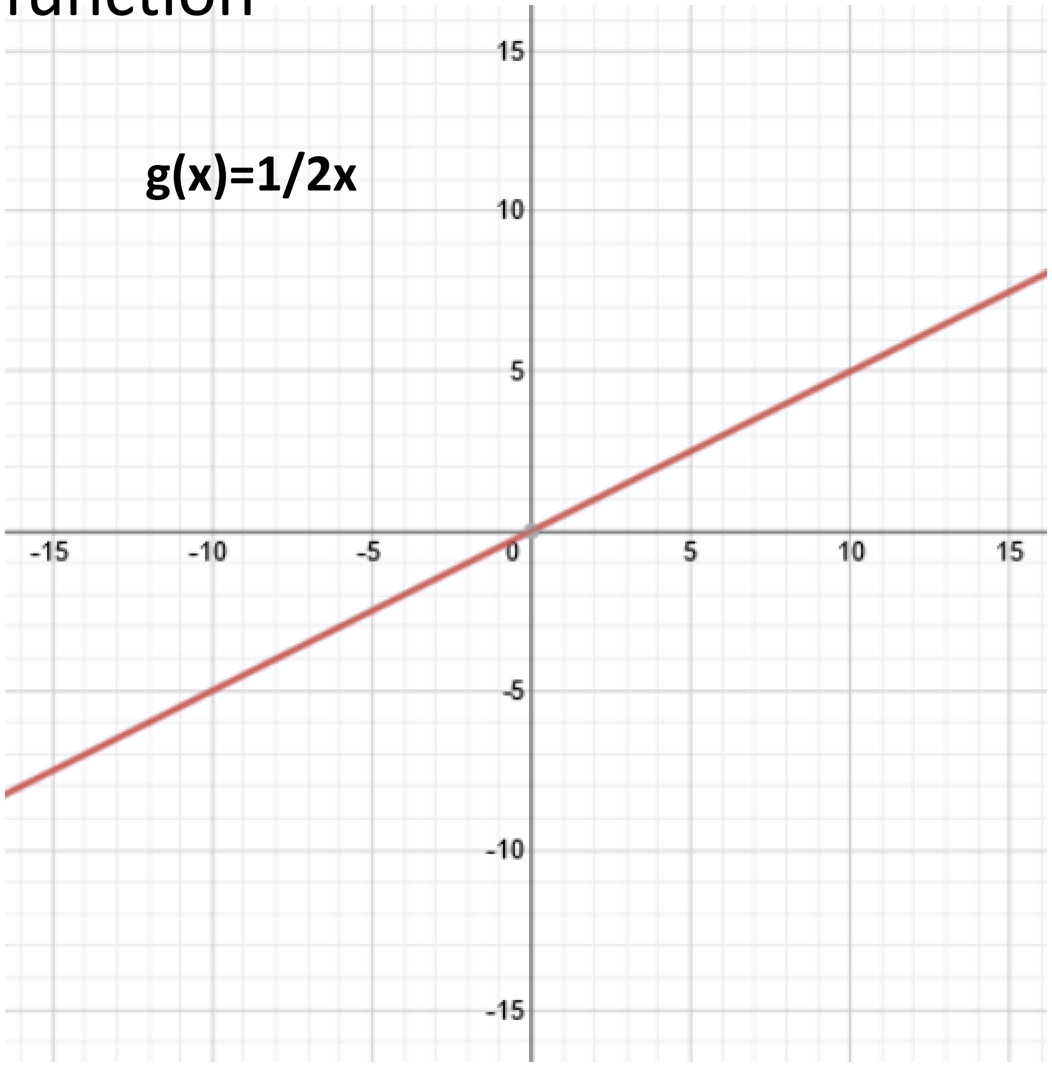
What do we know about the shape of the graph that can help us? **Increasing, centered at (0,0)**

How is it different? **No vertical or horizontal shifts. No Flip.**

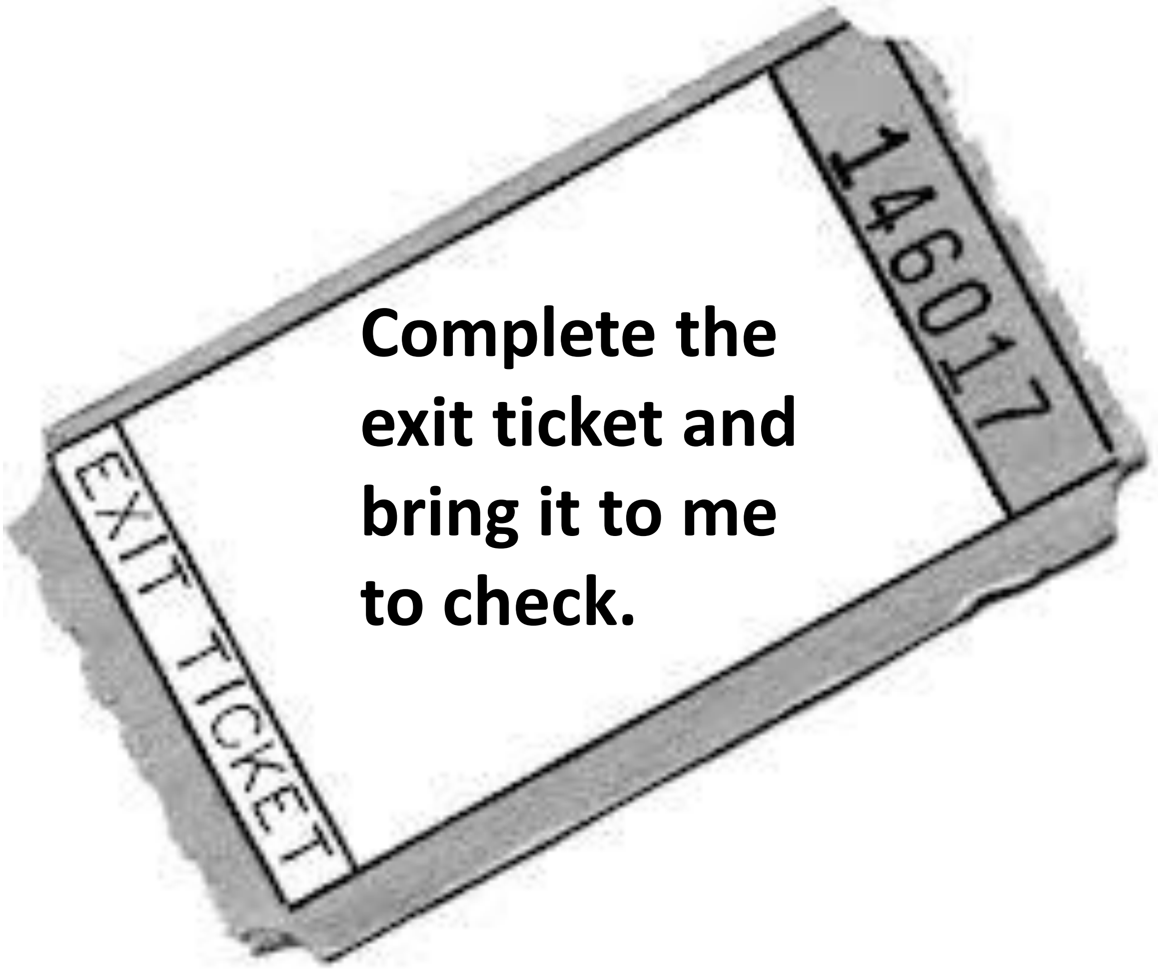
Find a point on this graph. **(10,5)**

Create an equation from what we know and solve for the stretch or compression factor.

y = cx
5 = c10
5/10 = c
1/2 = c



Did we meet our objectives?



Complete the exit ticket and bring it to me to check.