Warm - Up

Sunday, February 1, 2015

Draw a graph with the following characteristics:

Maximums at (-3,4) and (2,2)

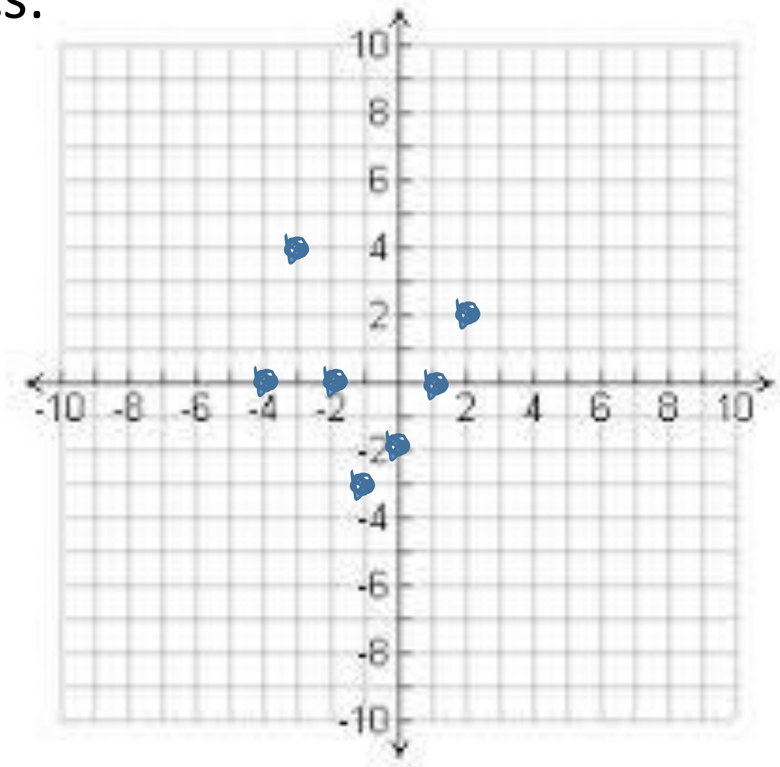
Minimum at (-1,-3)

X intercepts at (-4,0), (-2,0), (1,0), and (3,0)

Y intercept at (0,-2)

Increasing <u>Intervals</u> $(-\infty, -3)\ and\ \ (-1,2)$

Decreasing <u>Intervals</u> (-3.-1) and $(2, \infty)$



HINT: plot points first then connect the dots.

Functions

Objectives for today

Review 6 basic parent functions and be able to identify each function from an equation or a graph.

Identify the characteristics of Parent Functions.

Homework

Complete your parent functions worksheet

Complete Domain/Range worksheet

Any questions from last night's homework?

Homework Review

Check your answers.

Functions

Last time we met…

Domain and Range - What do we look at to determine?

Look at x values for Domain and y values for Range

Maximums and Minimums – What do these look like on the graphs?

Maximums are peaks in the graph and Minimums are valleys

X and Y Intercepts – Where are these found on the graph?

Intercepts are where the graph crosses the x and y axis

Increasing/Decreasing Intervals – How do we describe these intervals?

Use interval notation, use the x axis to define you interval

Look at your packet – Domain and Range worksheet

In groups or by yourself, work on problems 1-12

We'll work on 13 and 14 together

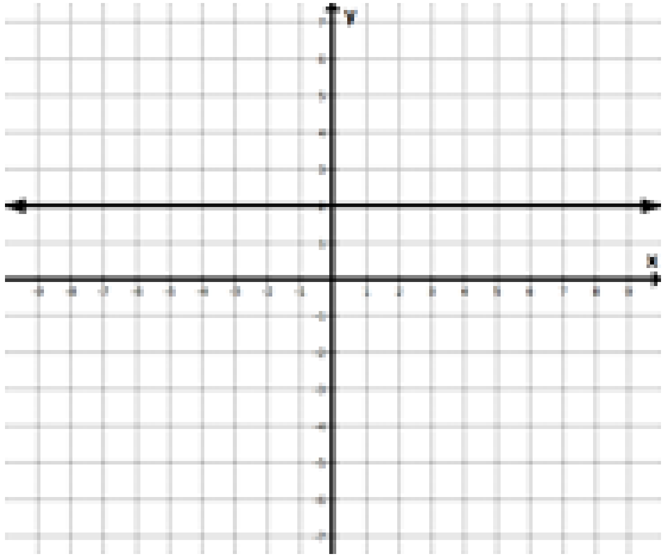
Introducing PARENT FUNCTIONS!

Parent functions are the simplest form of families of functions.

Function	Parent Function
$g(x) = 2x^2 + 4$	$f(x) = x^2$
$g(x) = x - 7$	$f(x) = x$
$g(x) = \frac{1}{3}(x-7)^3 - 1$	$f(x) = x^3$
$g(x) = \lvert x + 4 \rvert$	$f(x) = \lvert \mathrm{x} \rvert$

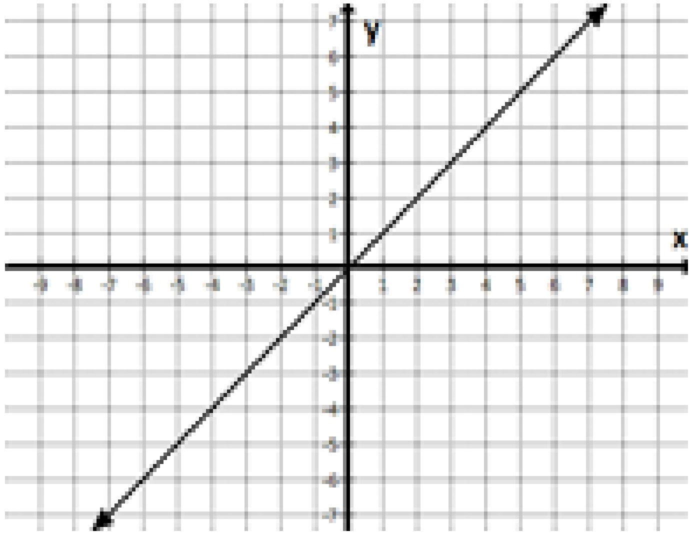
Parent Functions

Constant, f(x) = C



Domain ______		**Range** ______
End Behavior		
$as\ x \to -\infty, y \to$		$as\ x \to \infty, y \to$
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

Parent Functions

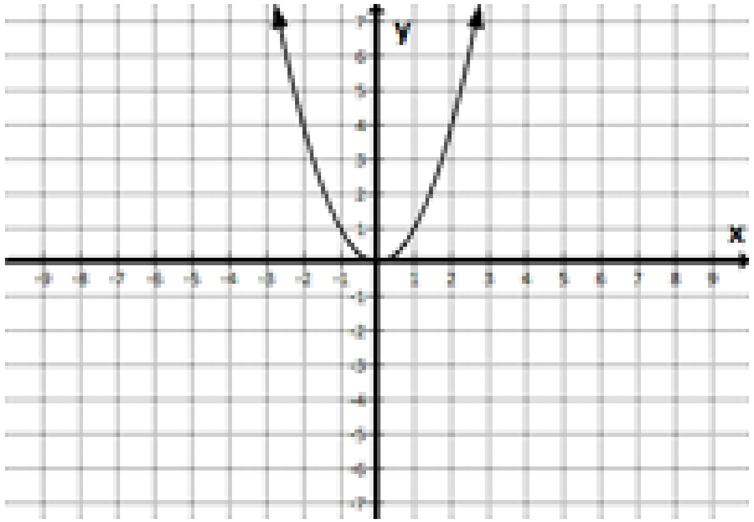


Linear, f(x)=x

Domain ______		**Range** ______
	End Behavior	
$as\ x \to -\infty, y \to$		$as\ x \to \infty, y \to$
	Critical Points	
Vertex	**X intercepts**	**Y intercepts**

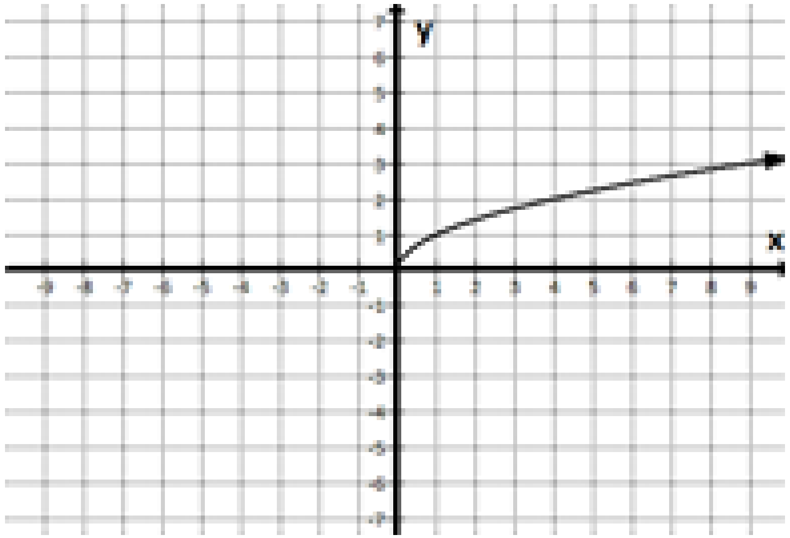
Parent Functions

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



Domain ________	**Range** ________	
End Behavior		
$as\ x \to -\infty, y \to$	$as\ x \to \infty, y \to$	
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

Parent Functions



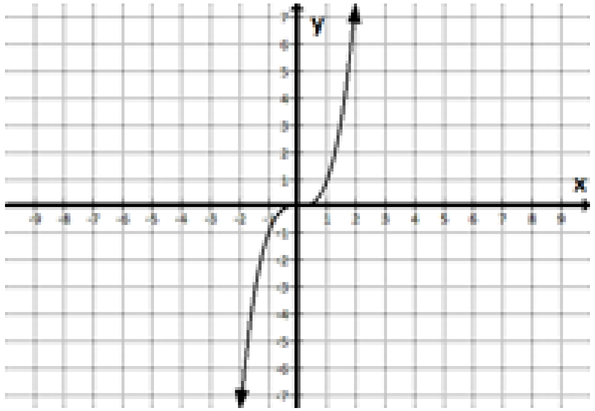
Radical (Square Root), f(x)=

Domain ______		**Range** ______
	End Behavior	
$as\ x \to -\infty, y \to$		$as\ x \to \infty, y \to$
	Critical Points	
Vertex	**X intercepts**	**Y intercepts**

Work with a partner to complete the remaining two functions.

Parent Functions

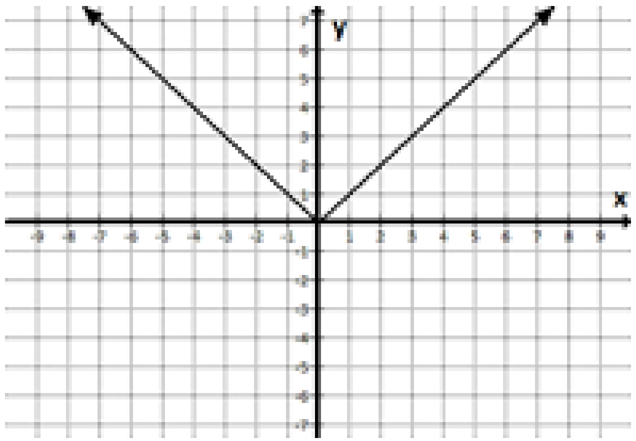
Cubic, f(x)=x³



Domain	Range
End Behavior	
$as\ x \to -\infty, y \to$	$as\ x \to \infty, y \to$

Critical Points		
Center	X intercepts	Y intercepts

Absolute Value, f(x)=|x|



Domain	Range
End Behavior	
$as\ x \to -\infty, y \to$	$as\ x \to \infty, y \to$

Critical Points		
Vertex	X intercepts	Y intercepts

Transformations

When a function is **shifted** in any way from its **parent function**, it is said to be **transformed.** We call this a **transformation of a function**. Functions are typically transformed either **vertically** or **horizontally.**

Two categories of Function Transformations

1. Rigid Transformations

The basic shape of the graph is unchanged.

Vertical Shifts
Horizontal Shifts
Reflections

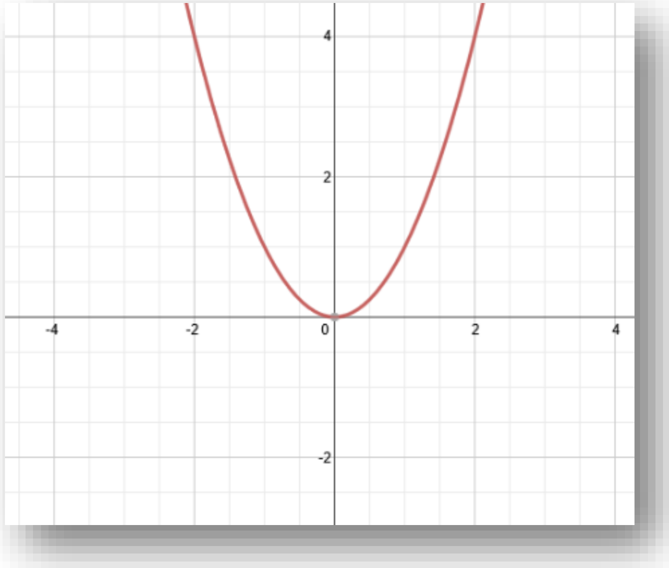
2. NonRigid Transformations

Cause a distortion, a change in the graph.

Stretches
Shrinks (Compressions)

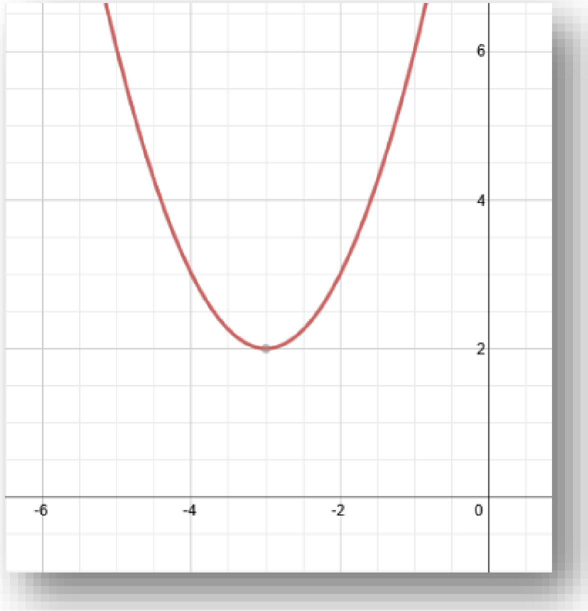
Transformations

Some simple transformations…



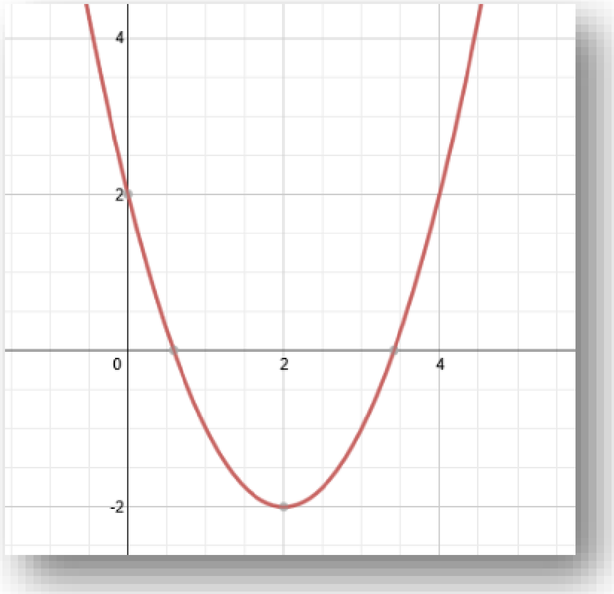
Parent Function

Quadratic
$f(x)=x^2$



Transformed Function

Shifted
Left 3 units
Up 2 units

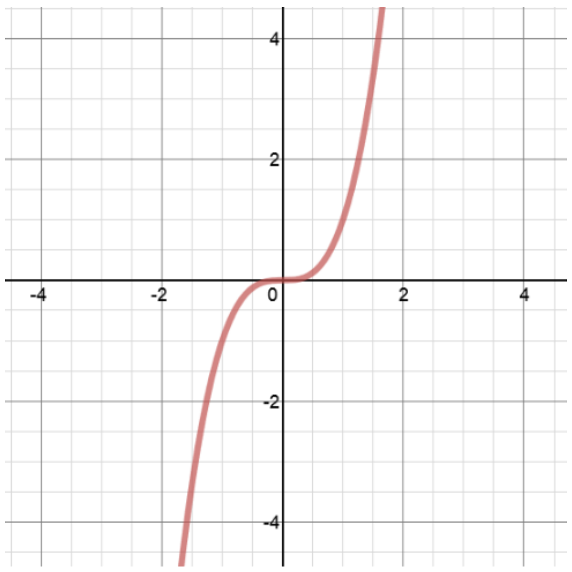


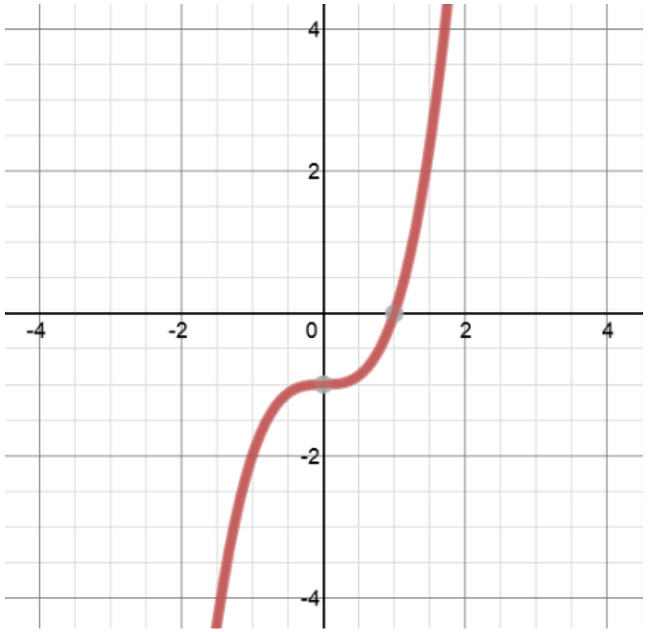
Transformed Function

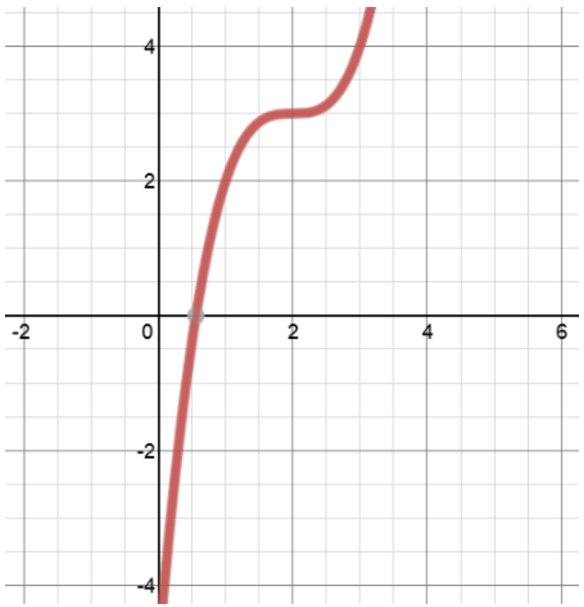
Shifted
Right 2 units
Down 2 units

Transformations

Identify the parent function and the transformations represented in the graphs.







Parent Function

Cubic
$f(x)=x^3$

Transformed Function

Shifted
Down 1 unit

Transformed Function

Shifted
Right 2 units
Up 3 units

So how do we represent these transformations algebraically?

Today we will focus on Rigid Transformations

Vertical Transformations

When functions are transformed on the **outside** of the f(x) part, you move the function up and down.

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**

Transformations

Vertical Transformations

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

How do we interpret this function notation?

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

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

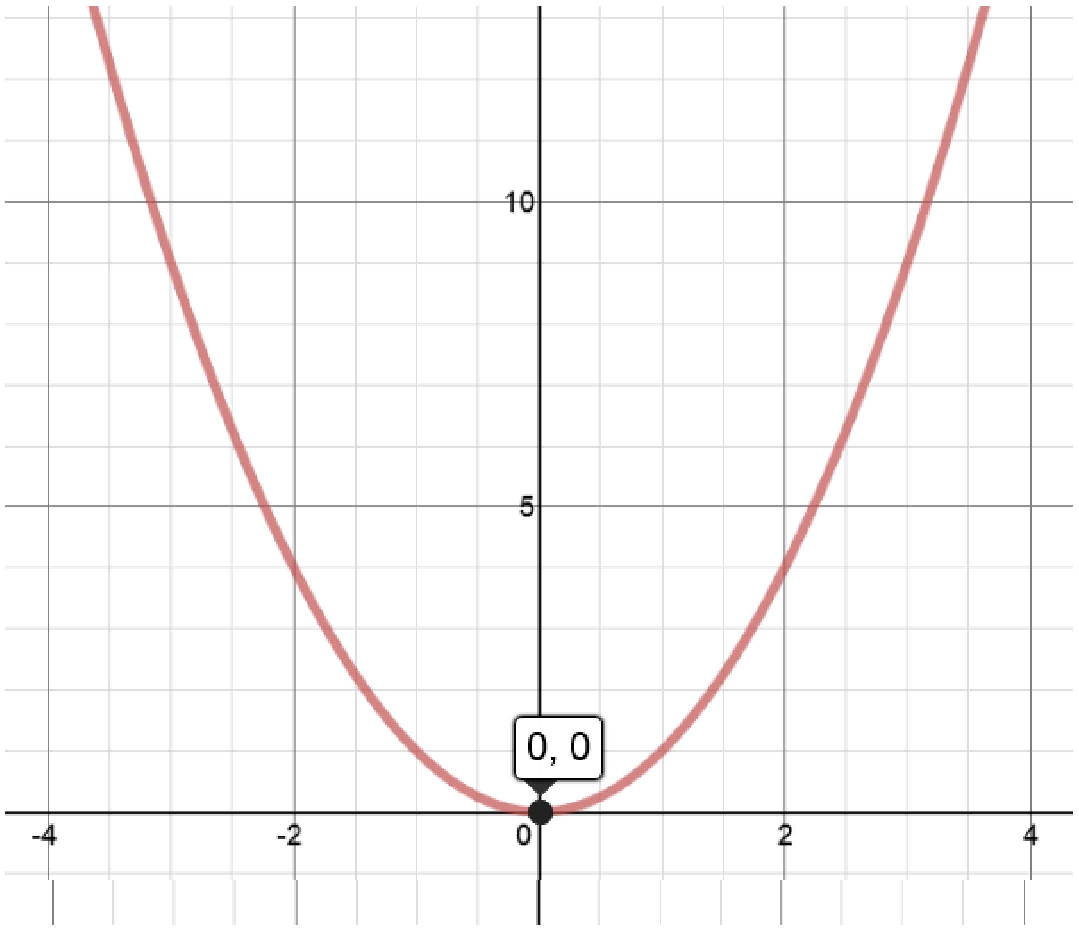
Let $f(x) = 2^x$ and $c = 7$ then $g(x) = 2^x + 7$

Transformations

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

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

X	f(x) X^2	g(x) X^2+3
3	9	12
2	4	7
1	1	4
0	0	3
-1	1	4
-2	4	7
-3	9	12

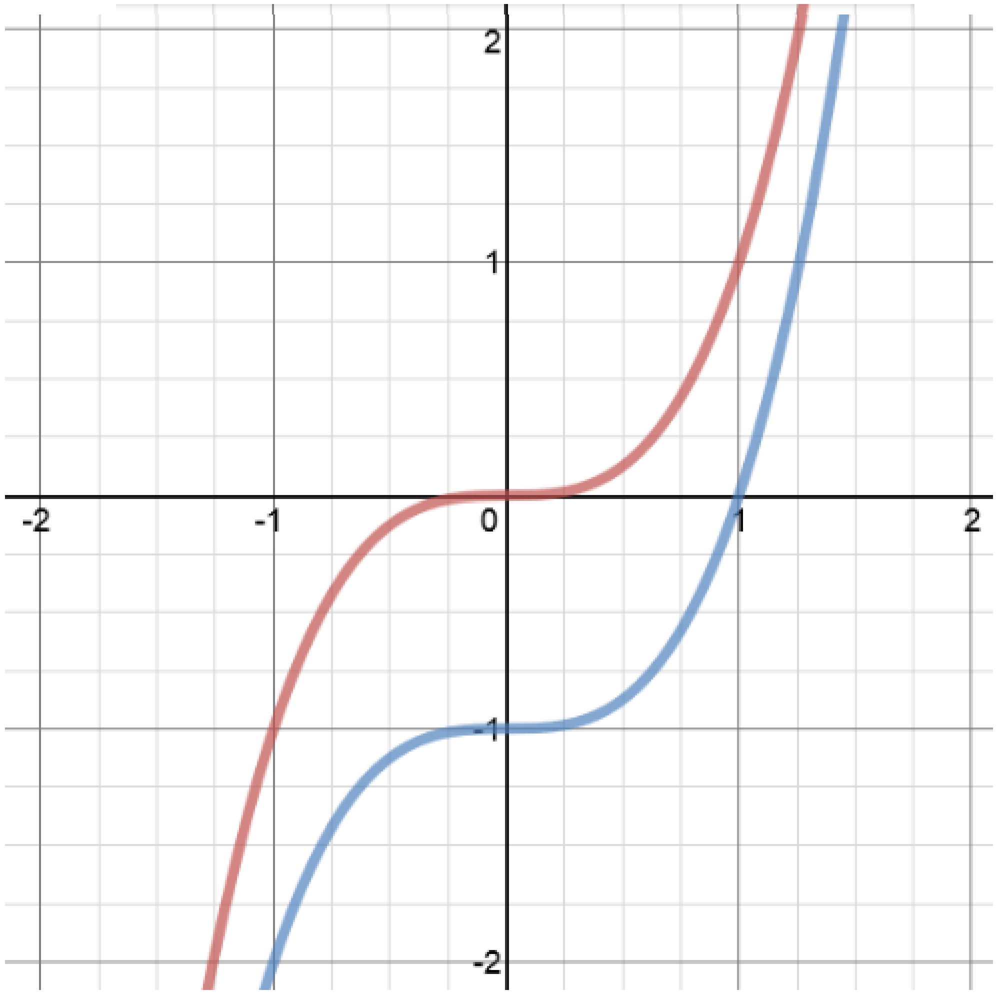


Transformations

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

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

X	f(x) X^3	g(x) X^3-1
3	27	26
2	8	7
1	1	0
0	0	-1
-1	-1	-2
-2	-8	-9
-3	-27	-28



Transformations

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

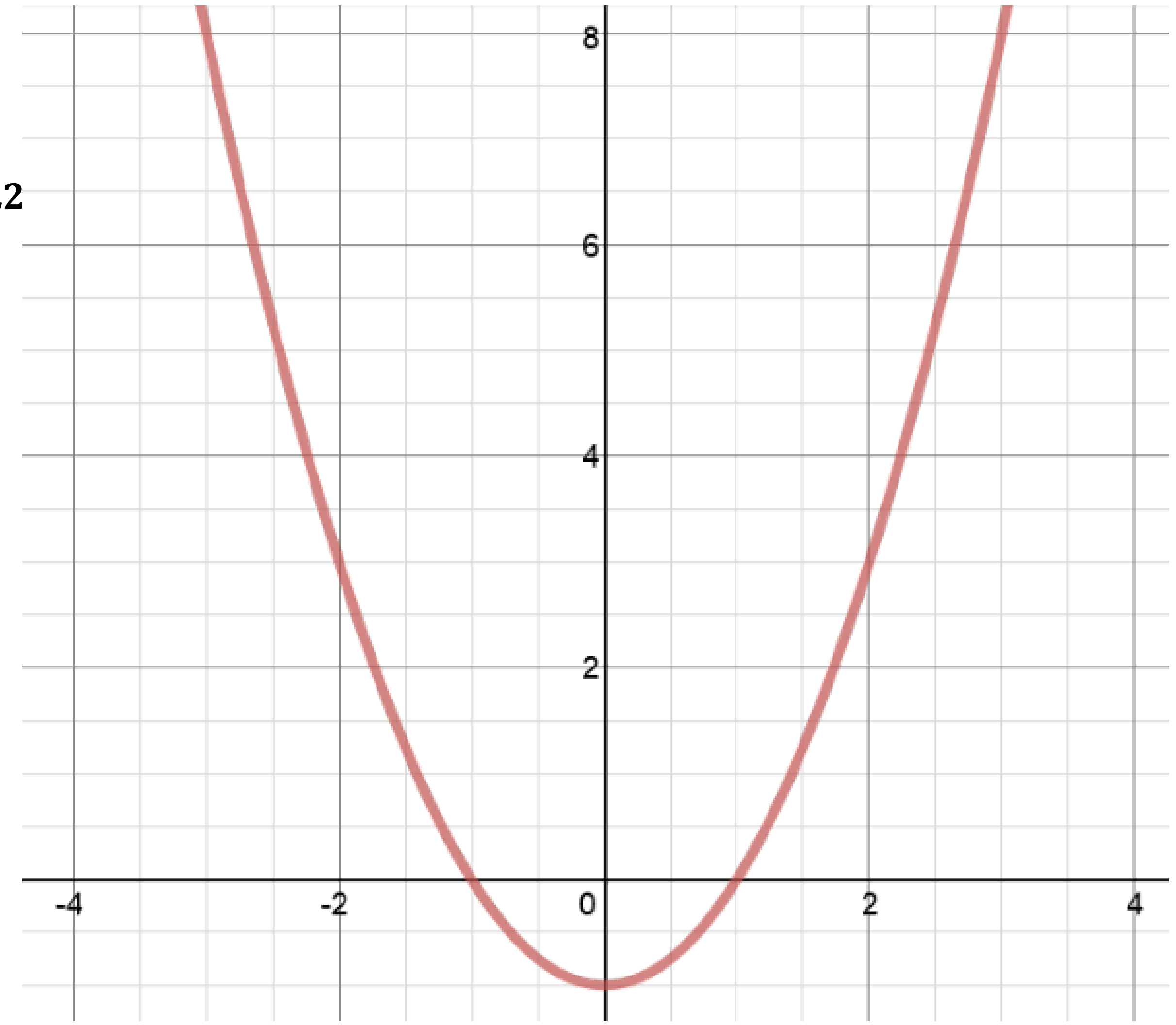
$g(x) = x^2 - 1$

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

Critical point that can help us? **Vertex**

Which way did it go? **Down**

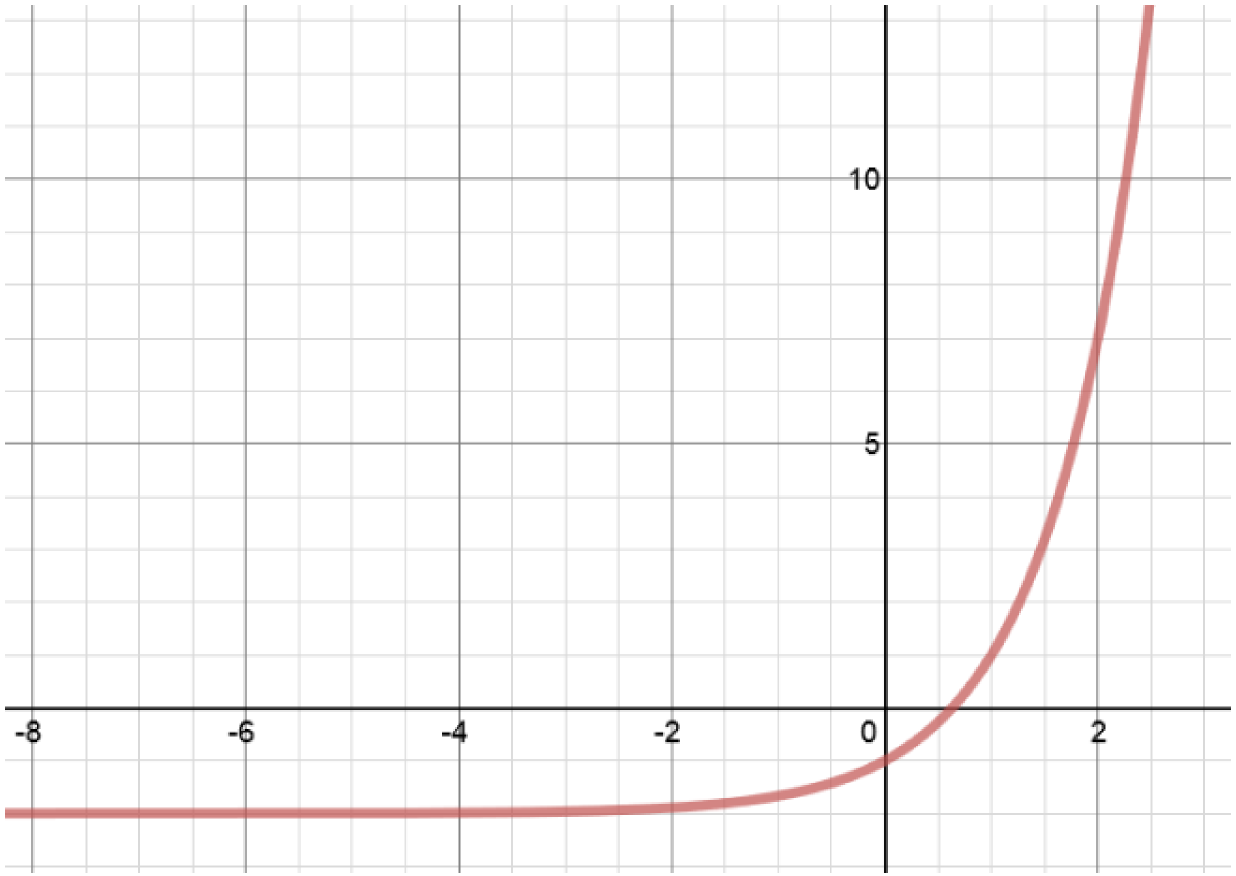
By how much? **1 unit**



Transformations

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

$g(x) = b^x - 2$



Parent Function? **Log, $f(x) = b^x$**

Critical point that can help us? **Intercepts**

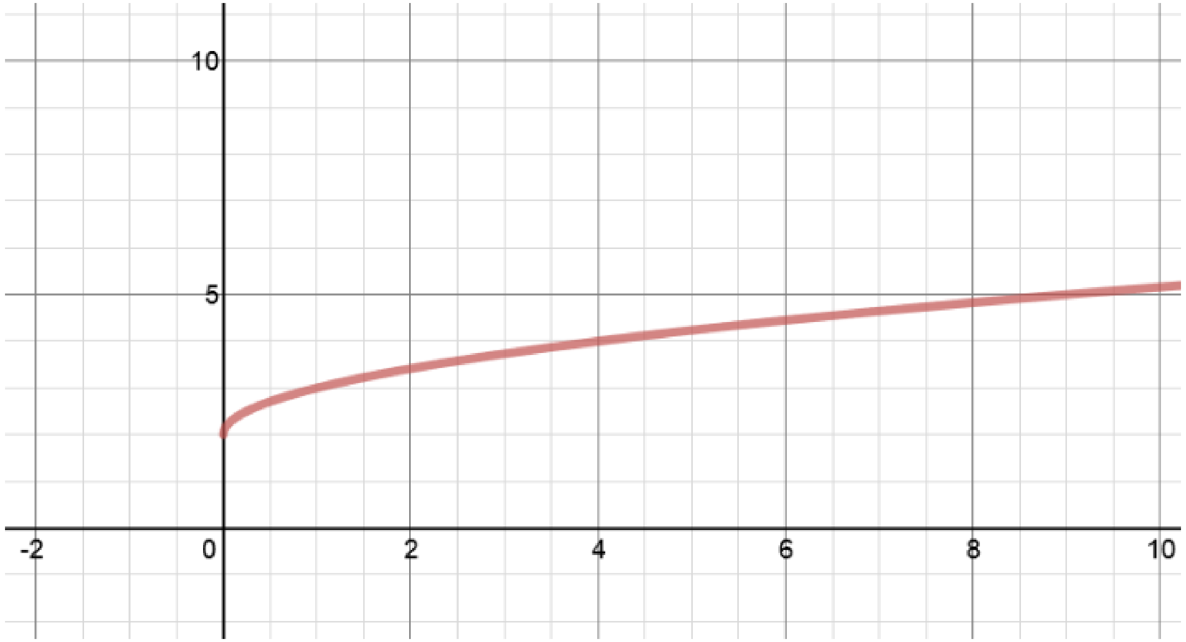
Which way did it go? **Down**

By how much? **2 units**

Transformations

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

$g(x) = \sqrt{x} + 2$



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

Critical point that can help us? **Intercepts**

Which way did it go? **Up**

By how much? **2 units**

Horizontal Translations

When functions are transformed on the **inside** of the “f(x) part”, you move the function left and right. Notice the direction is the opposite of the sign inside the “f(x) part”.

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

Transformations

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

How do we interpret this function notation?

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

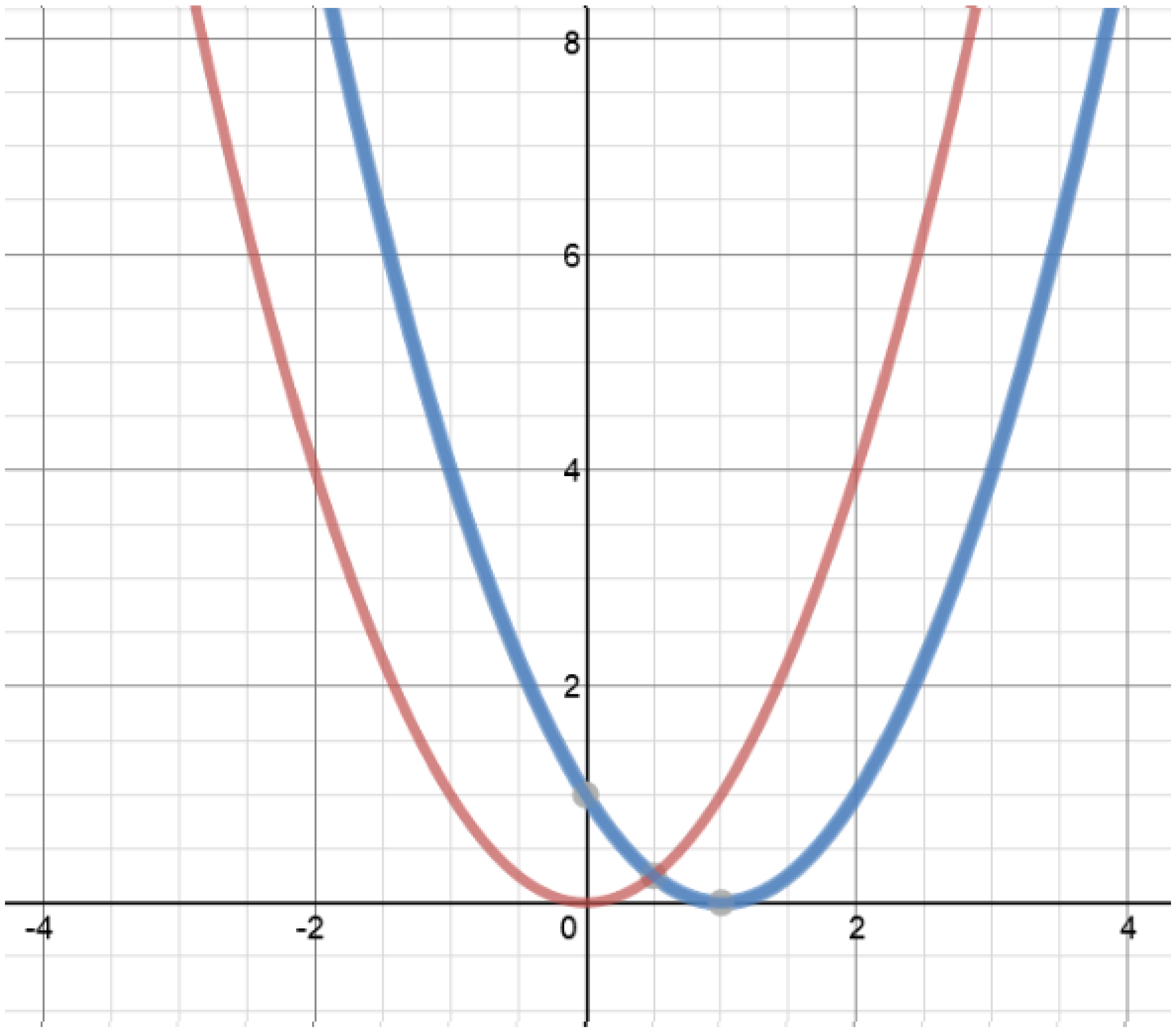
Let $f(x) = \sqrt{x}$ and $c = -4$ then $g(x) = \sqrt{x-4}$

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

Transformations

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

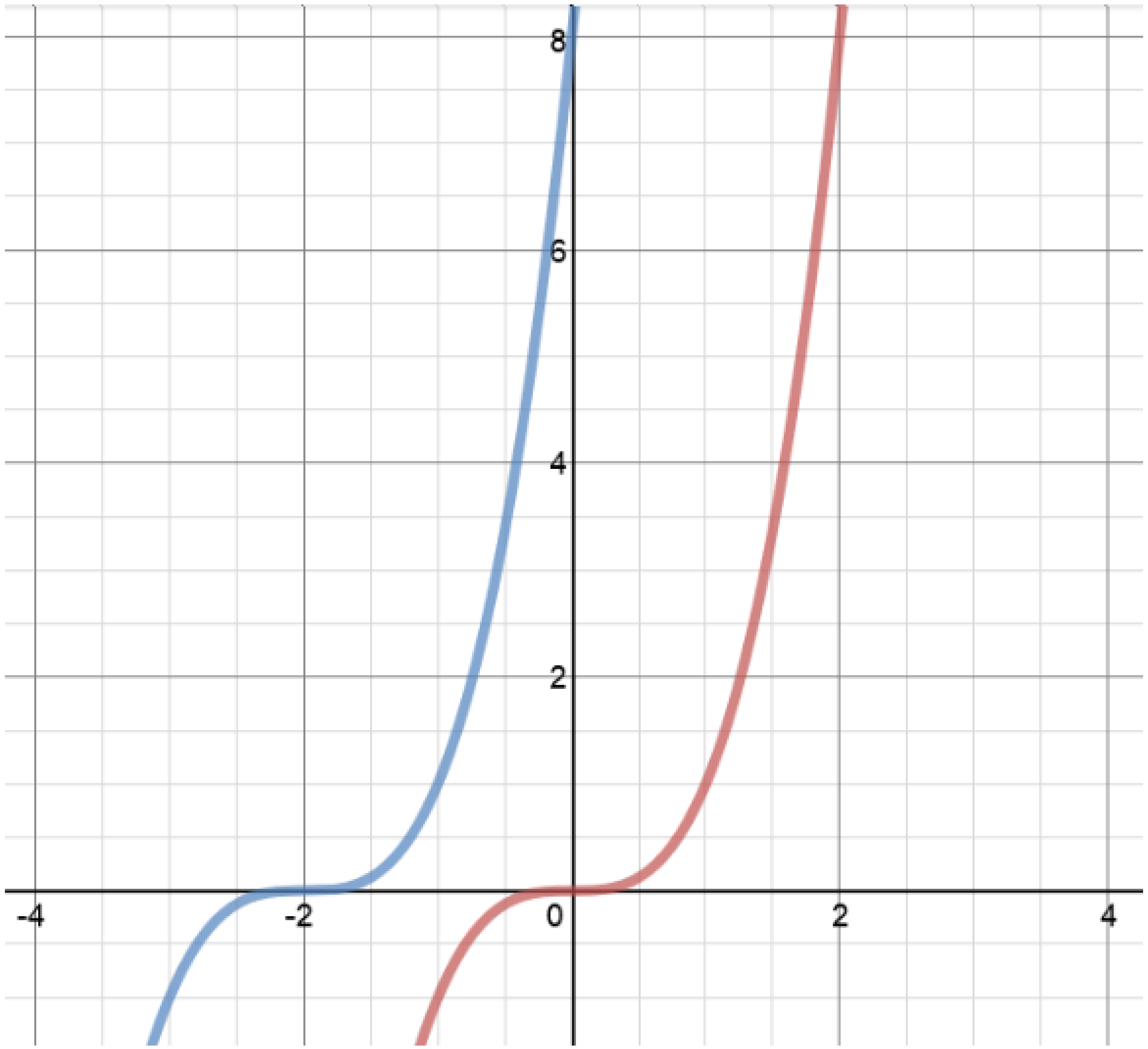
$$g(x) = (x - 1)^2$$



Transformations

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

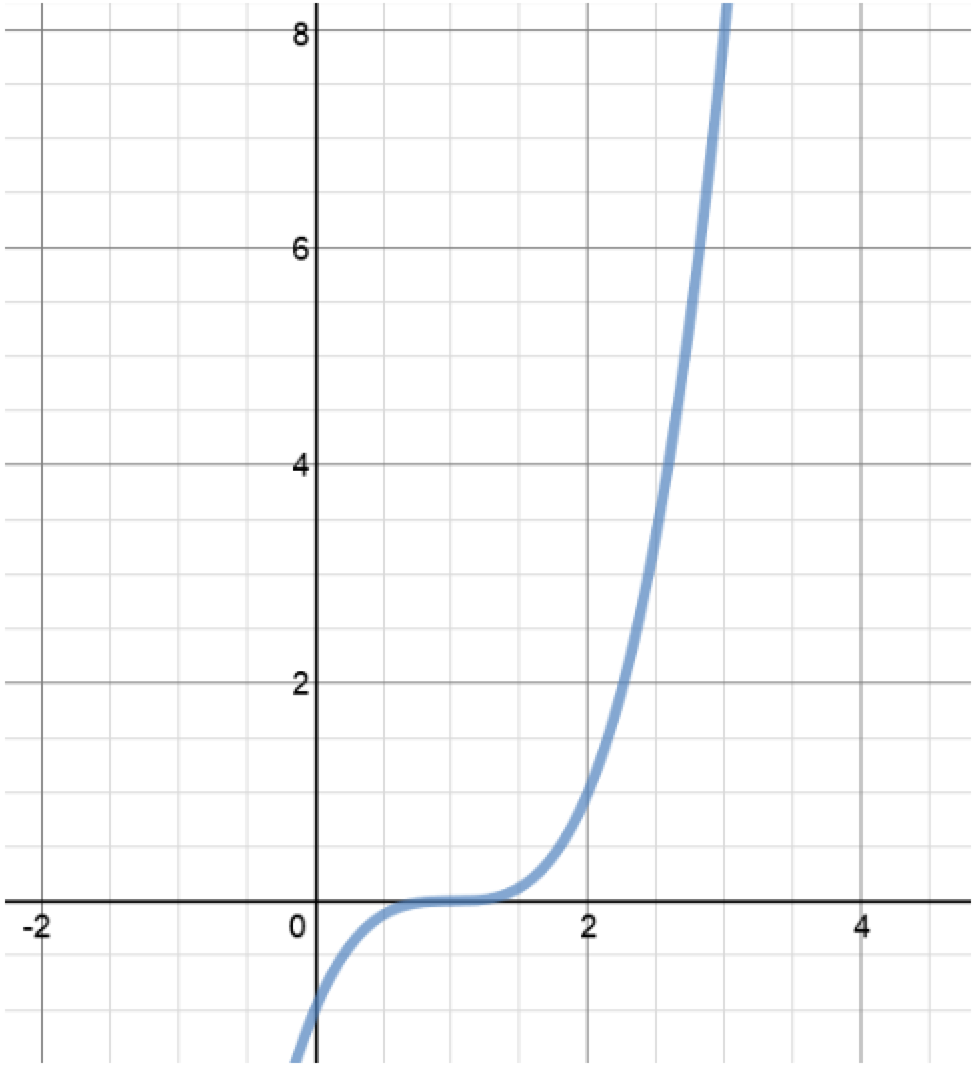
$$g(x) = (x + 2)^3$$



Transformations

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

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



Parent Function? **Cubic, $f(x) = x^3$**

Critical point that can help us? **Intercepts**

Which way did it go? **Left**

By how much? **1 unit**

Transformations

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

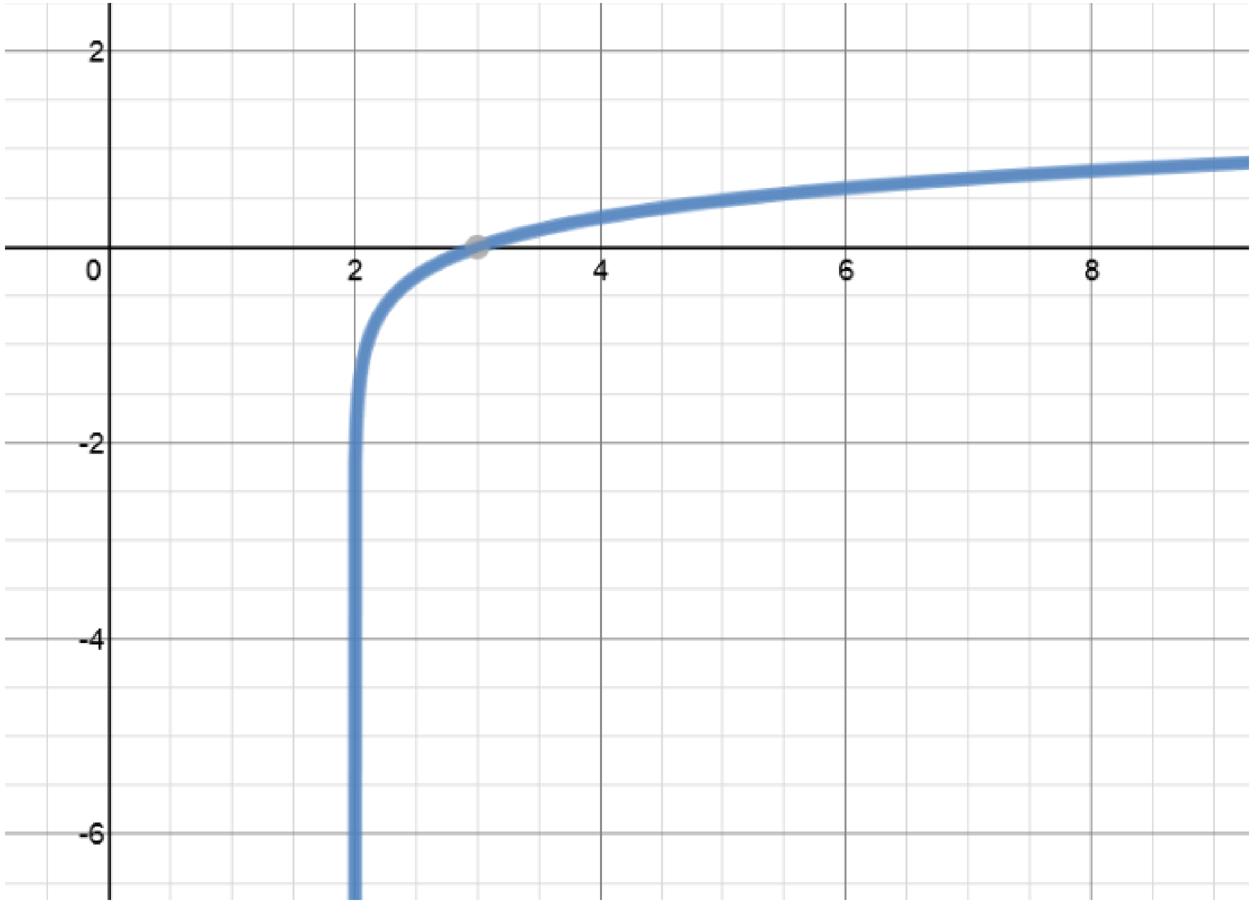
Parent Function? **Log, $f(x) = Log\ x$**

Critical point that can help us? **Intercepts**

Which way did it go? **Right**

By how much? **2 units**

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



Transformations

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

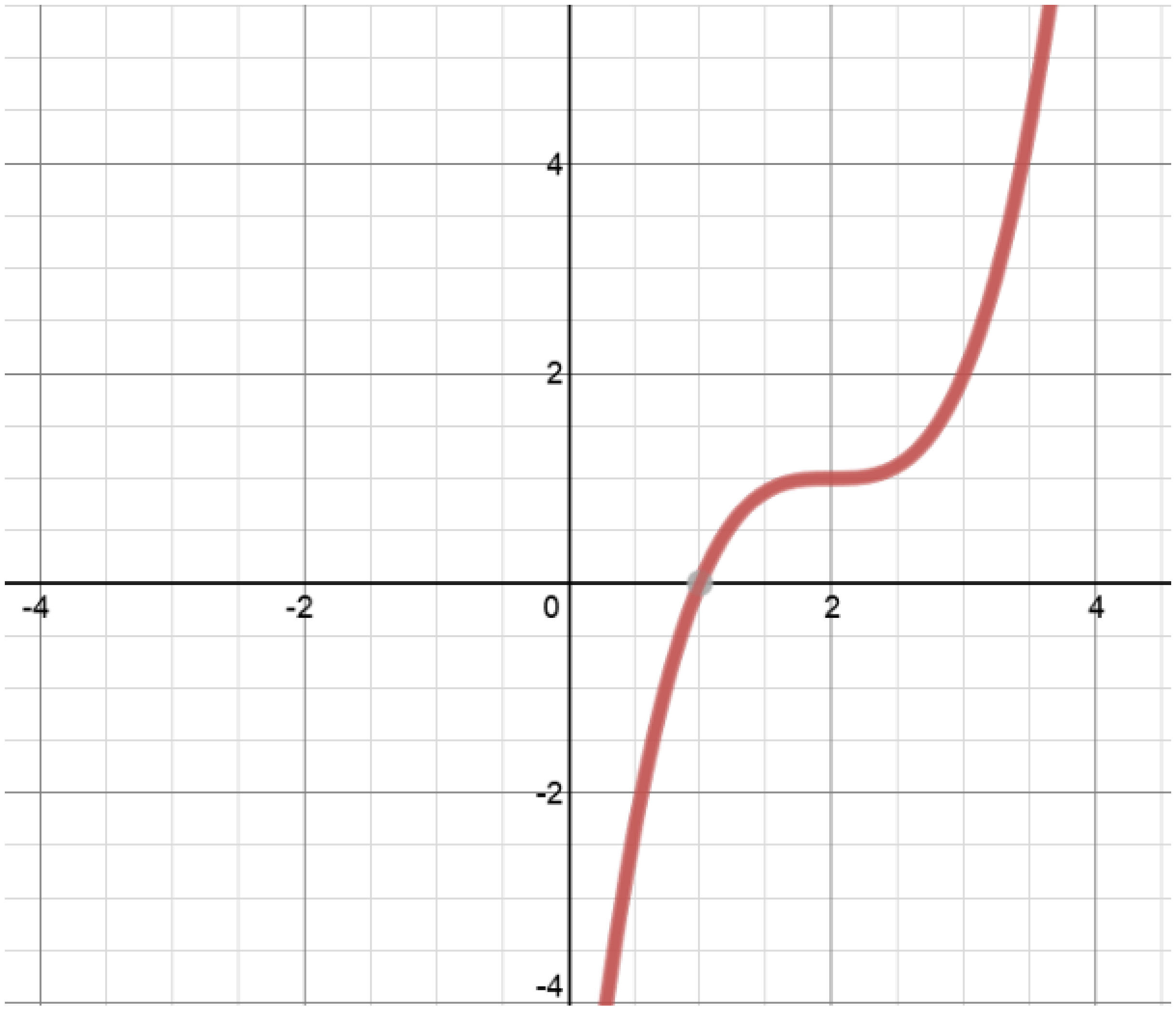
$f(x) = (x-2)^3+1$

Parent Function? **Cubic, $f(x) = x^3$**

Critical point that can help us? **Intercepts**

Which way did it go? **Left <u>and</u> up**

By how much? **Left 2 and up 1**



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

How do we interpret this function notation?

Let $f(x) = x^2$, then $-f(x) = -x^2$ and $f(-x) = (-x)^2$

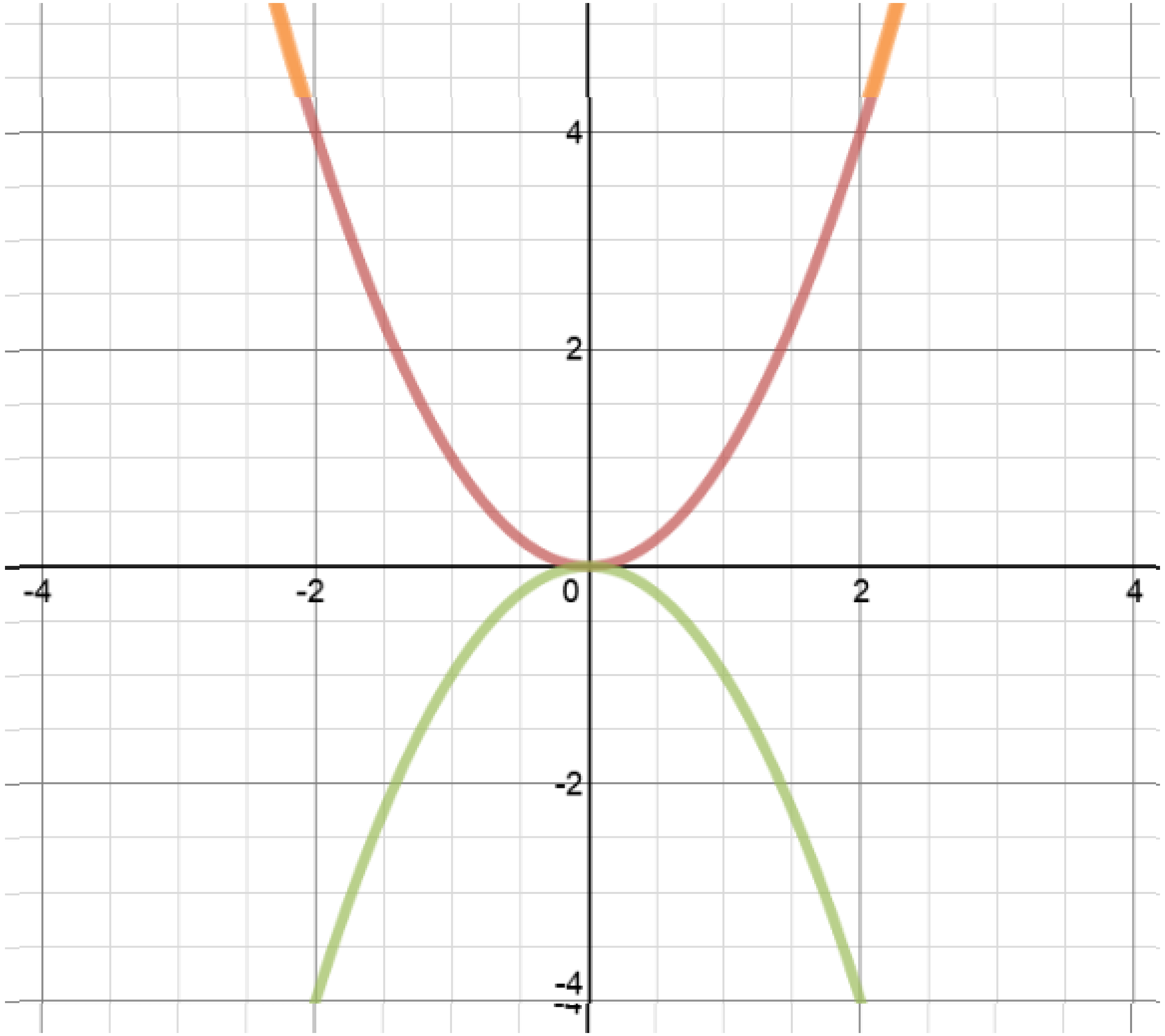
Let $f(x) = \sqrt{x}$, then $-f(x) = -\sqrt{x}$ and $f(-x) = \sqrt{-x}$

Let $f(x) = 2^x$, then $-f(x) = -2^x$ and $f(-x) = 2^{-x}$

Reflection across the x axis

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

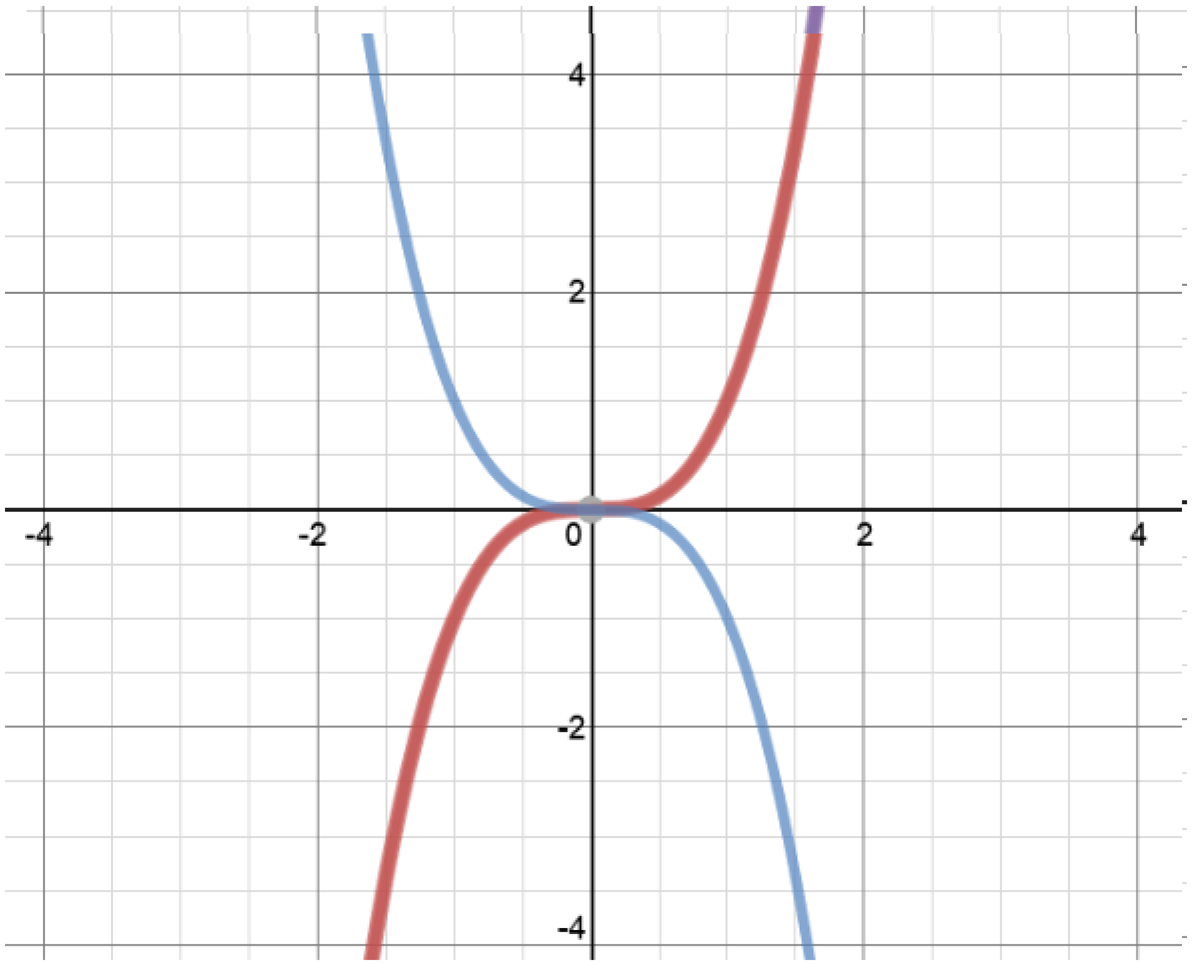
X	X^2	$-X^2$
3	9	-9
2	4	-4
1	1	-1
0	0	0
-1	1	-1
-2	4	-4
-3	9	-9



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.

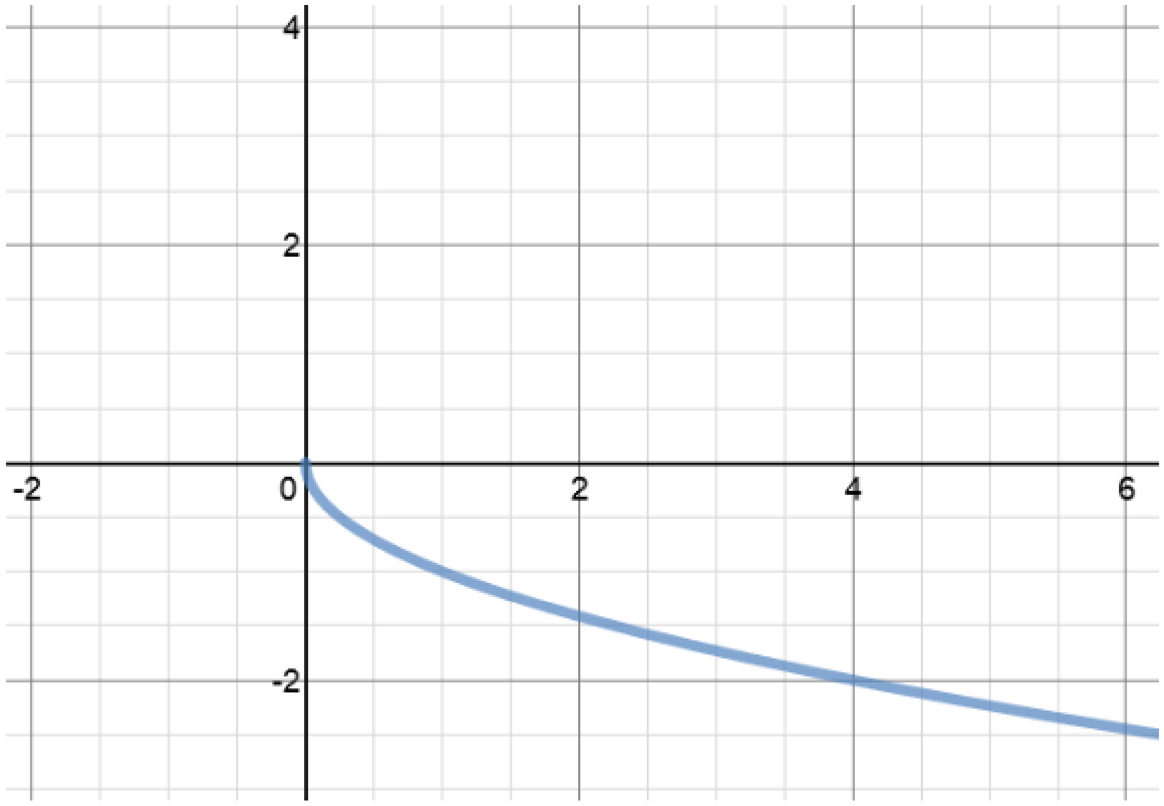
Parent Function? **Radical, $f(x) = \sqrt{x}$**

Critical point that can help us? **Intercepts**

Which way did it go? **No Change**

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

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



Summary of the Rigid Transformations

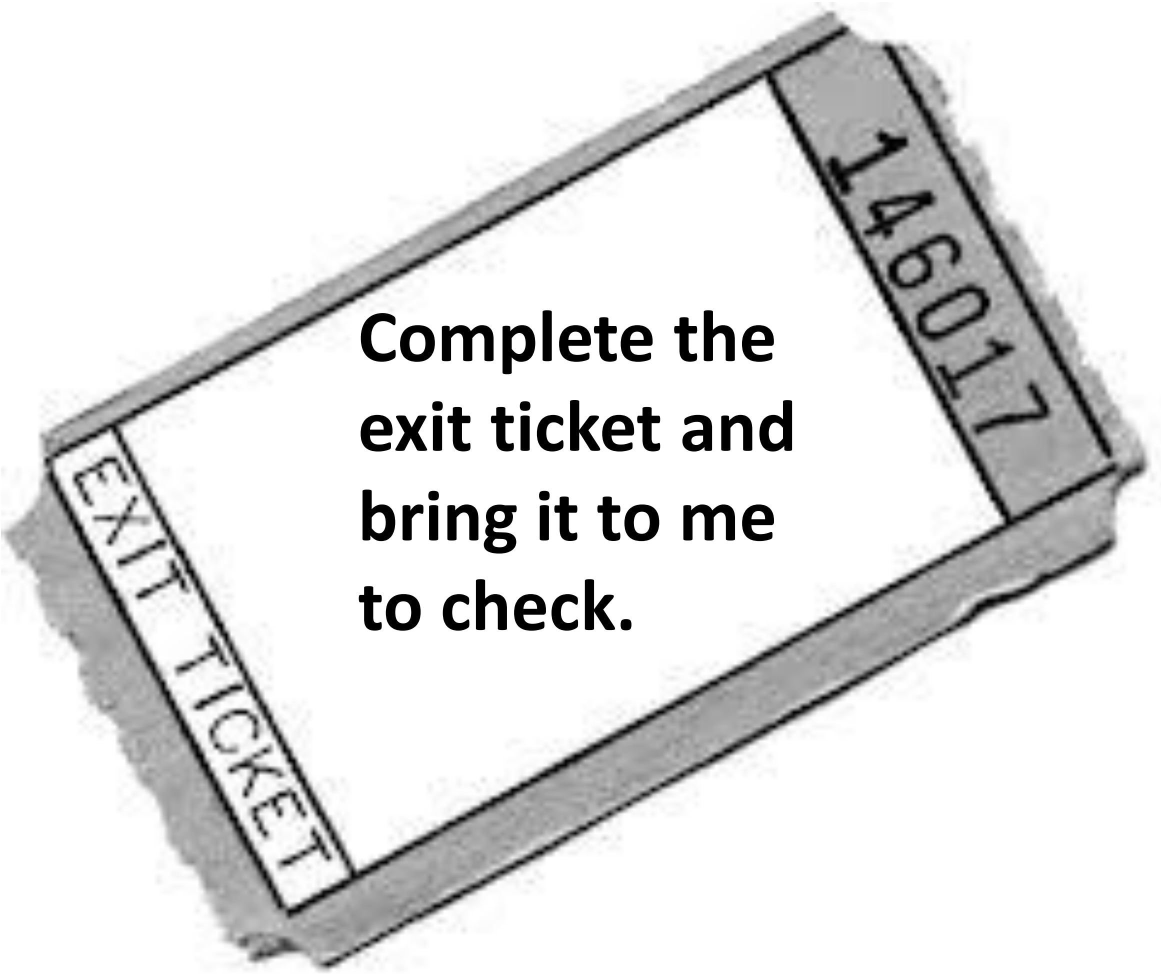
Function Notation	Description of Transformation
$g(x) = f(x) \pm c$	Vertical shift **up** C units if C is **positive**
	Vertical shift **down** C units if C is **negative**

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

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

Functions

Did we meet our objectives?



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