Warm -up

Identify the following:

Wednesday, January 28, 2015

Intervals

Increasing: $(-\infty, -1), (1, \infty)$

Decreasing: $(-1,1)$

X Intercepts: $(-2,0)$, $(0.5,0)$, $(1.5,0)$

Y Intercepts: $(0,1)$

Relative Maximum(s): $(-1,3)$

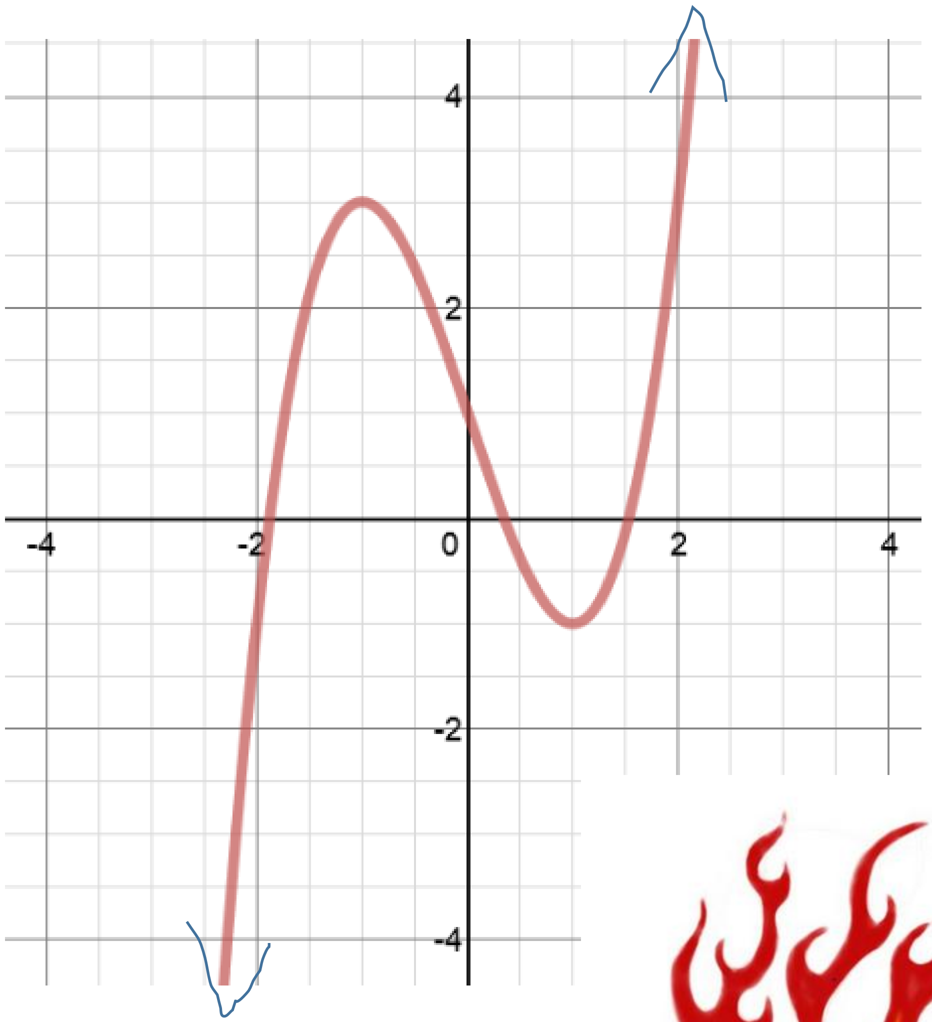
Relative Minimum(s): $(1,-1)$

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

End Behavior: $as\ x \to \infty, y \to \infty$

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



So far…

Most confusing Function Characteristics	
Domain	Interval of X values
Range	Interval of Y values
Increasing Interval	Interval of X values
Decreasing Interval	Interval of X values
End Behavior	Look at the far ends of the graph. If it’s pointing up, Y is approaching positive infinity. If it’s pointing down, Y is approaching negative infinity.

Functions

Objectives for today

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

Identify vertical and horizontal function transformations from both a graph and a function equation.

Homework

Complete your parent functions worksheet

Translations on Parent Functions Review even

Any questions from last night's homework?

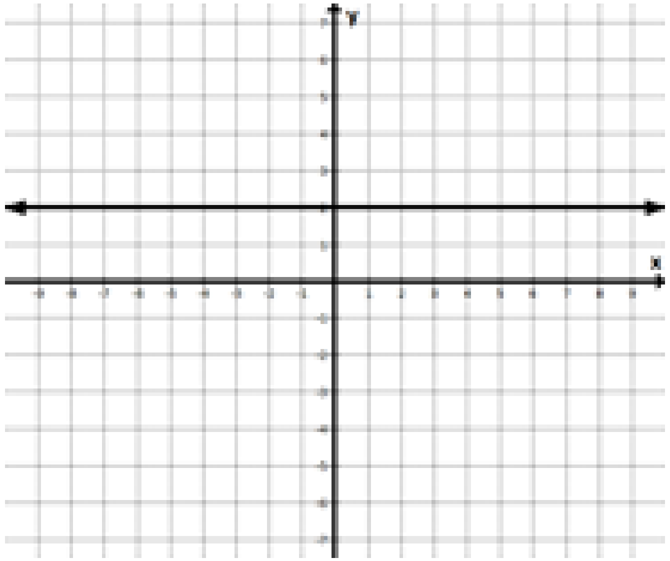
Introducing PARENT FUNCTIONS!

Parent functions are the simplest form of families of functions.

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

Parent Functions

Constant, f(x) = C



Domain:

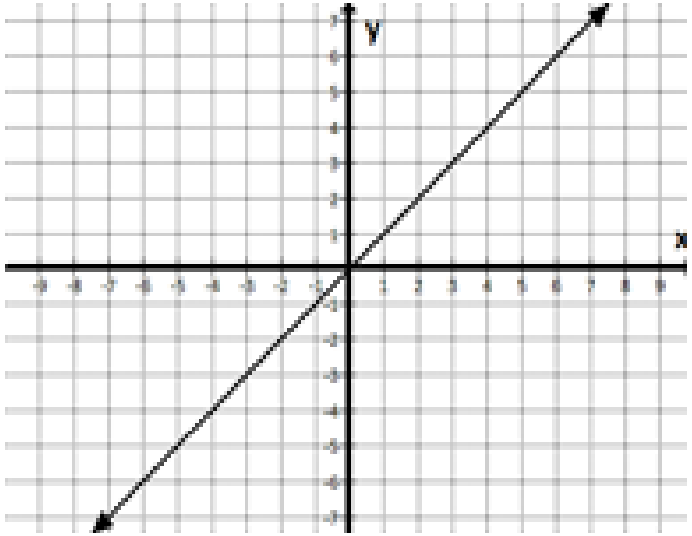
Range:

End Behavior:

Critical Points:

Increasing/Decreasing:

Linear, f(x)=x



Domain:

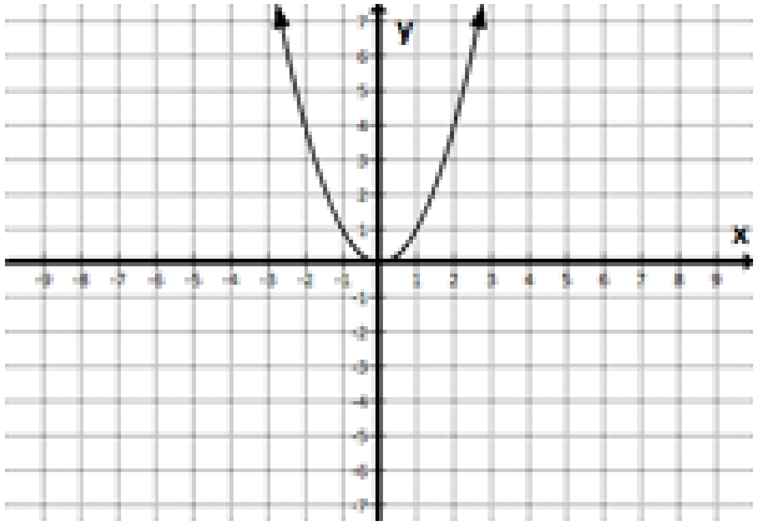
Range:

End Behavior:

Critical Points:

Increasing/Decreasing:

Quadratic, f(x)=x²



Domain:

Range:

End Behavior:

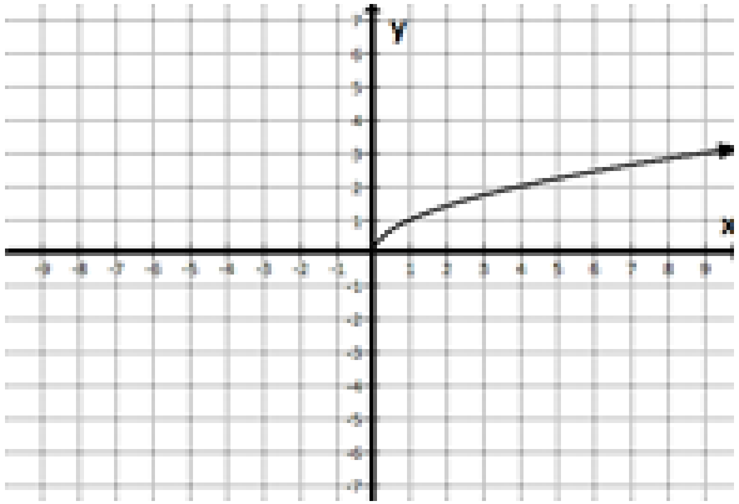
Critical Points:

Increasing/Decreasing:

Parent Functions

Square Root

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



Domain:

Range:

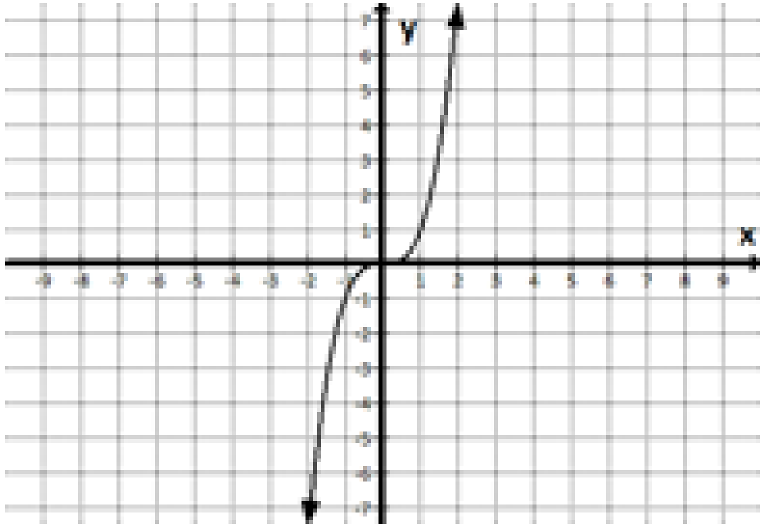
End Behavior:

Critical Points:

Increasing/Decreasing:

Cubic

$f(x) = x^3$



Domain:

Range:

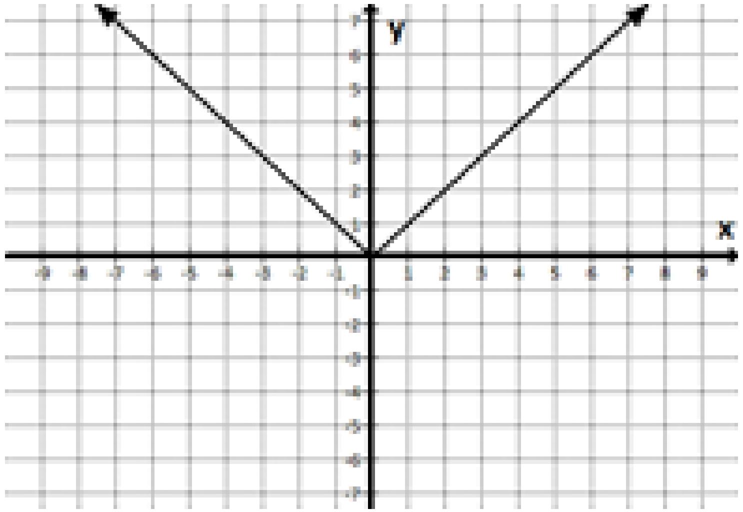
End Behavior:

Critical Points:

Increasing/Decreasing:

Absolute Value

$f(x) = |x|$



Domain:

Range:

End Behavior:

Critical Points:

Increasing/Decreasing:

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.

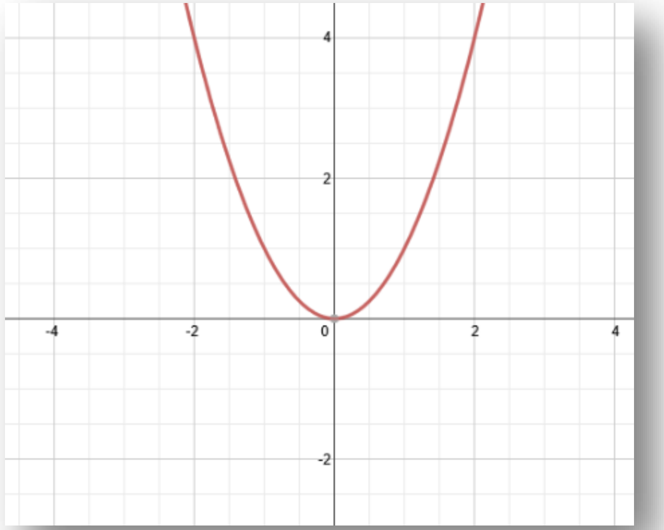
Vertical Shifts
Horizontal Shifts
Reflections

2. NonRigid Transformations

Cause a distortion, a change in the graph.

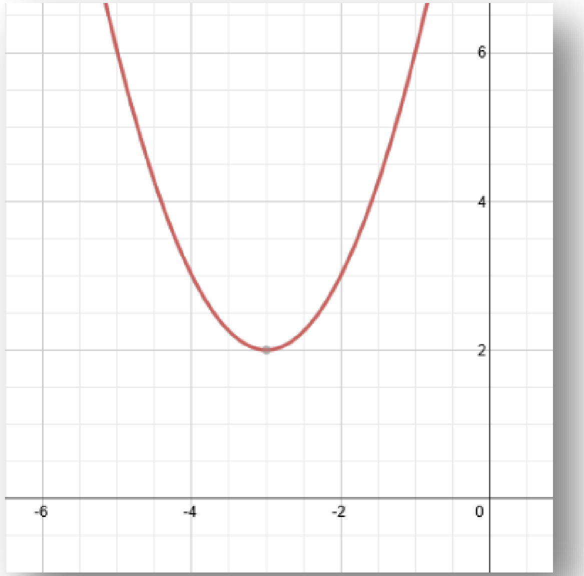
Stretches
Shrinks (Compressions)

Some simple transformations…



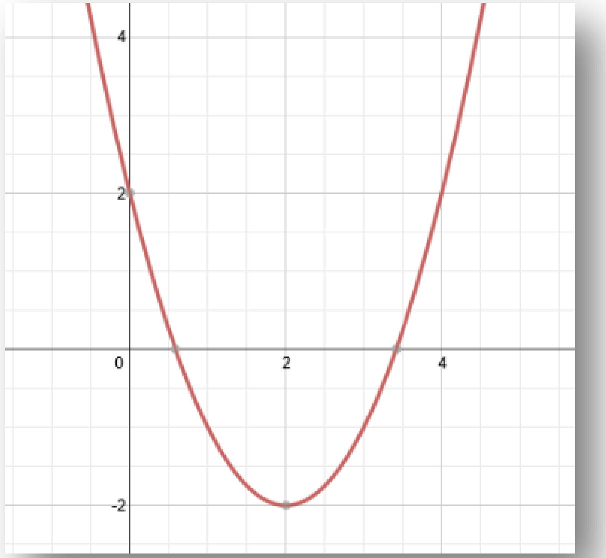
Parent Function

Quadratic
$f(x)=x^2$



Transformed Function

Shifted
Left 3 units
Up 2 units

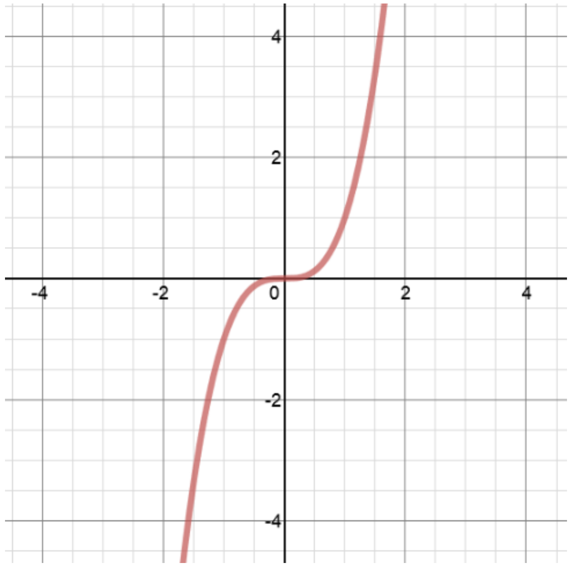


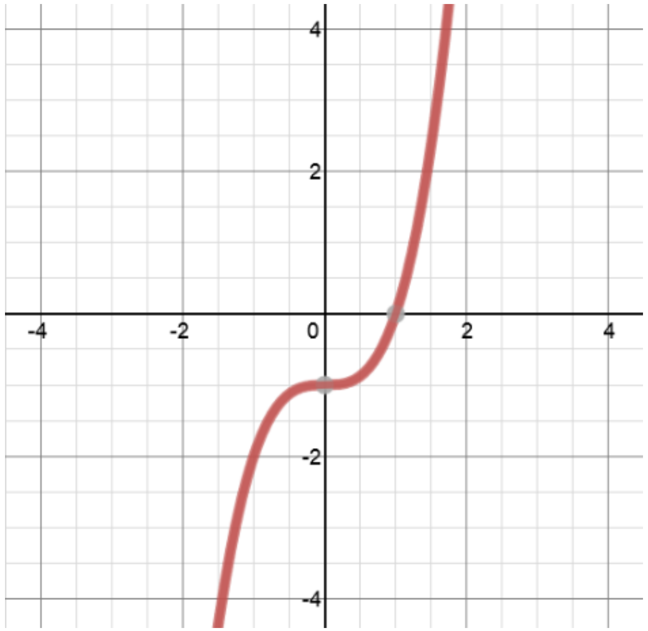
Transformed Function

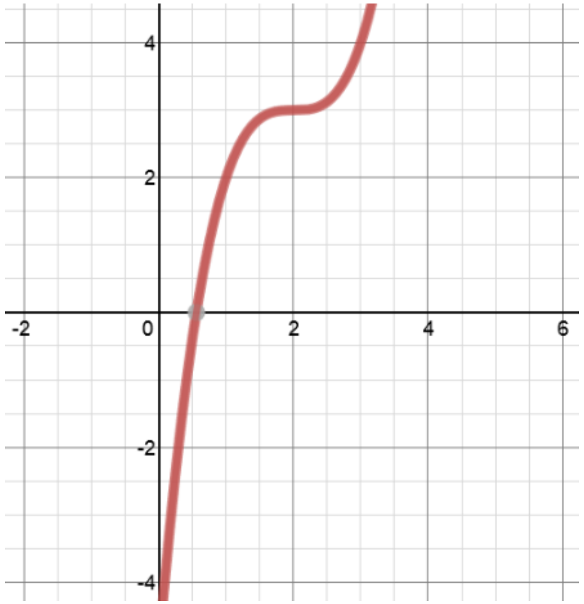
Shifted
Right 2 units
Down 2 units

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

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**

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 $g(x) = \sqrt{x} - 4$

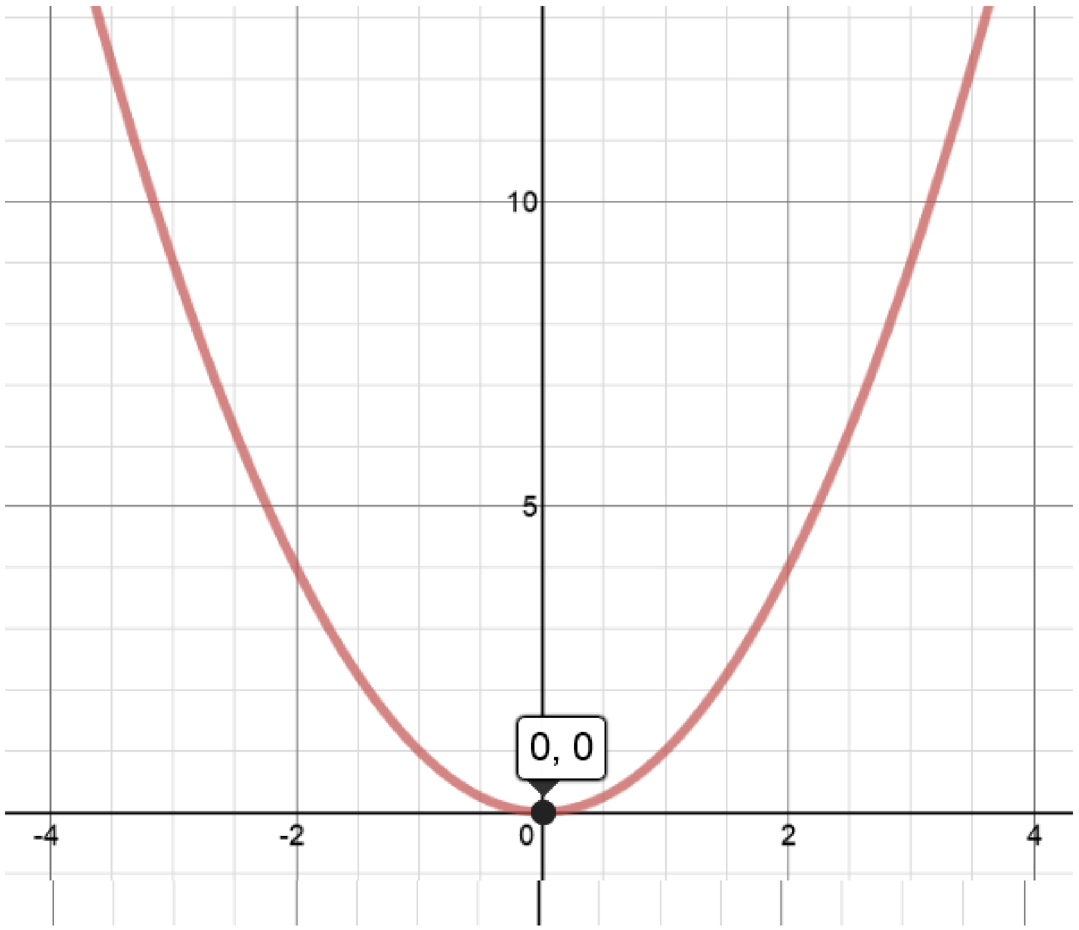
Let $f(x) = 2^x$ and $c = 7$ then $g(x) = 2^x + 7$

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

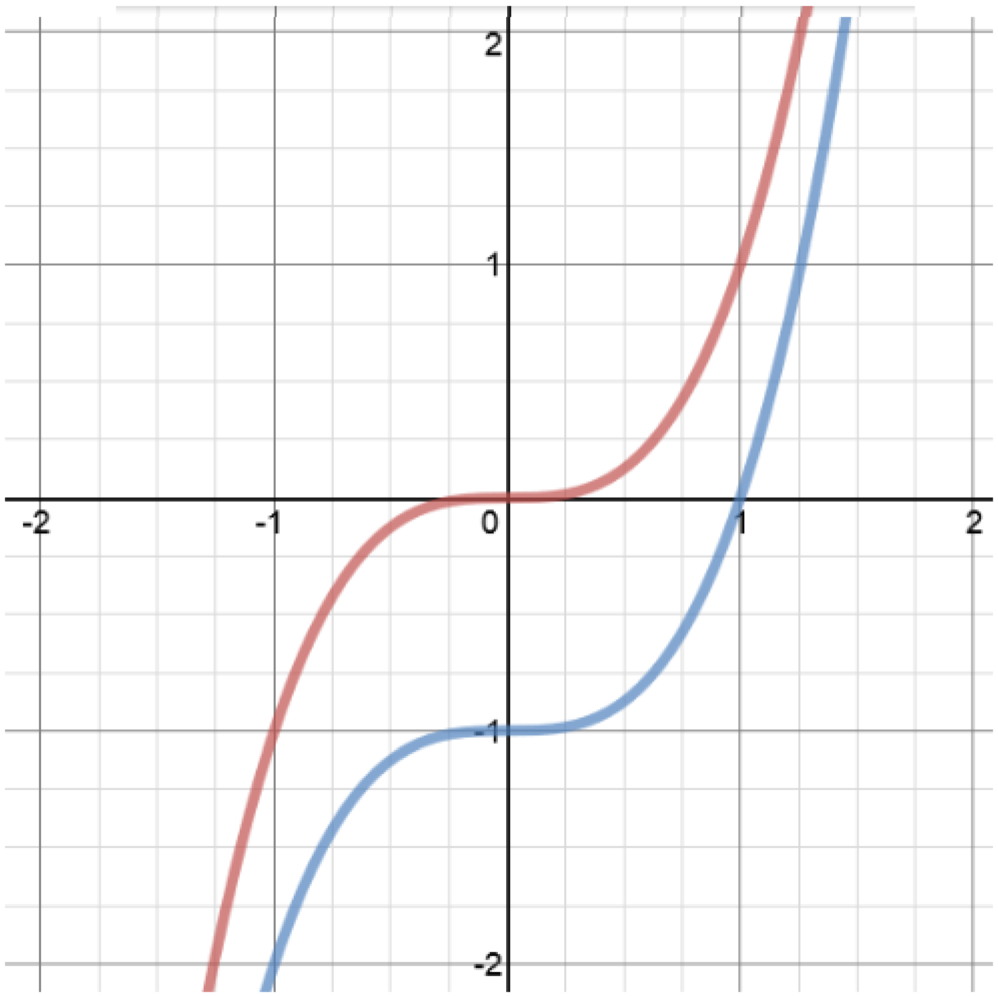


Transformations

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.

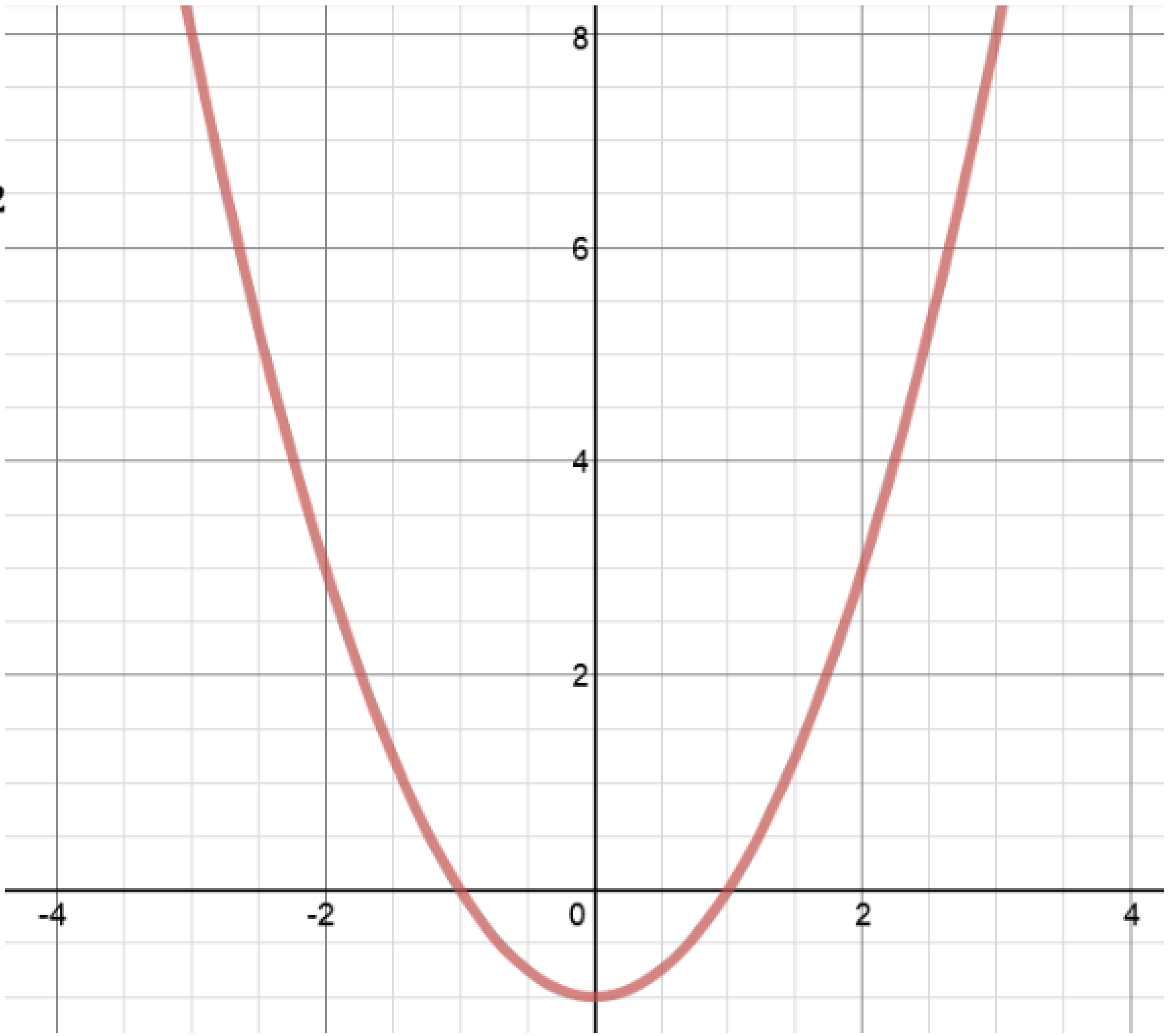
$g(x) = x^2 - 1$

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.

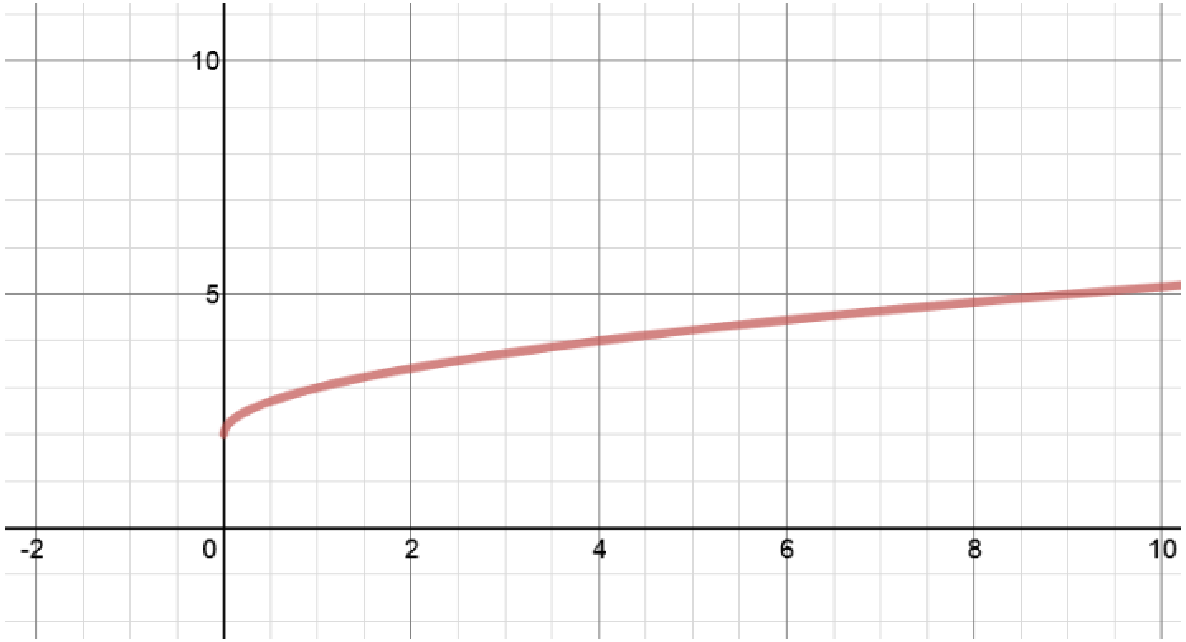
Parent Function? **Radical,** $f(x) = \sqrt{x}$

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

Which way did it go? **Up**

By how much? **2 units**

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



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

How do we interpret this function notation?

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

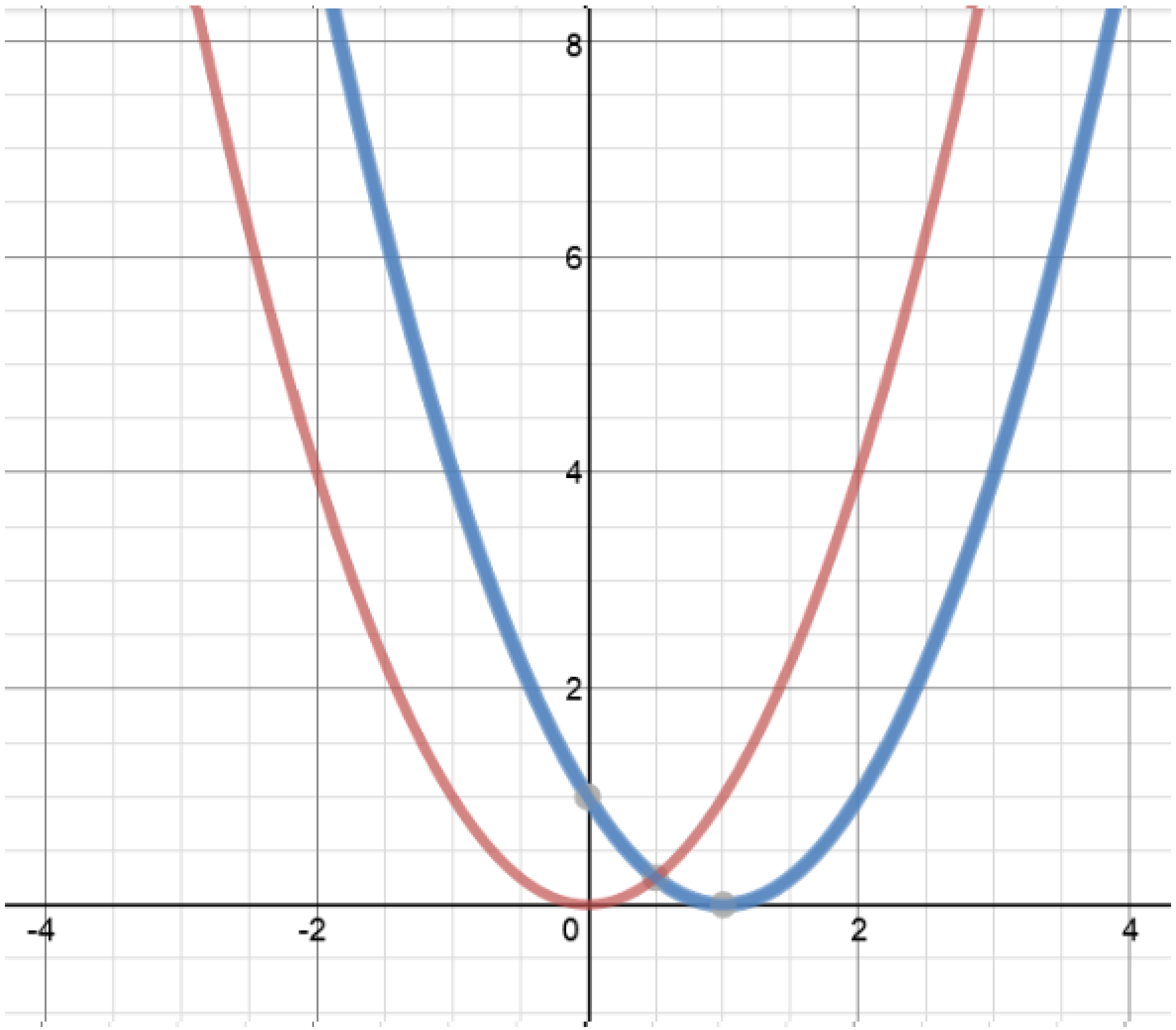
Let $f(x) = \sqrt{x}$ and $c = -4$ then $g(x) = \sqrt{x-4}$

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?"**

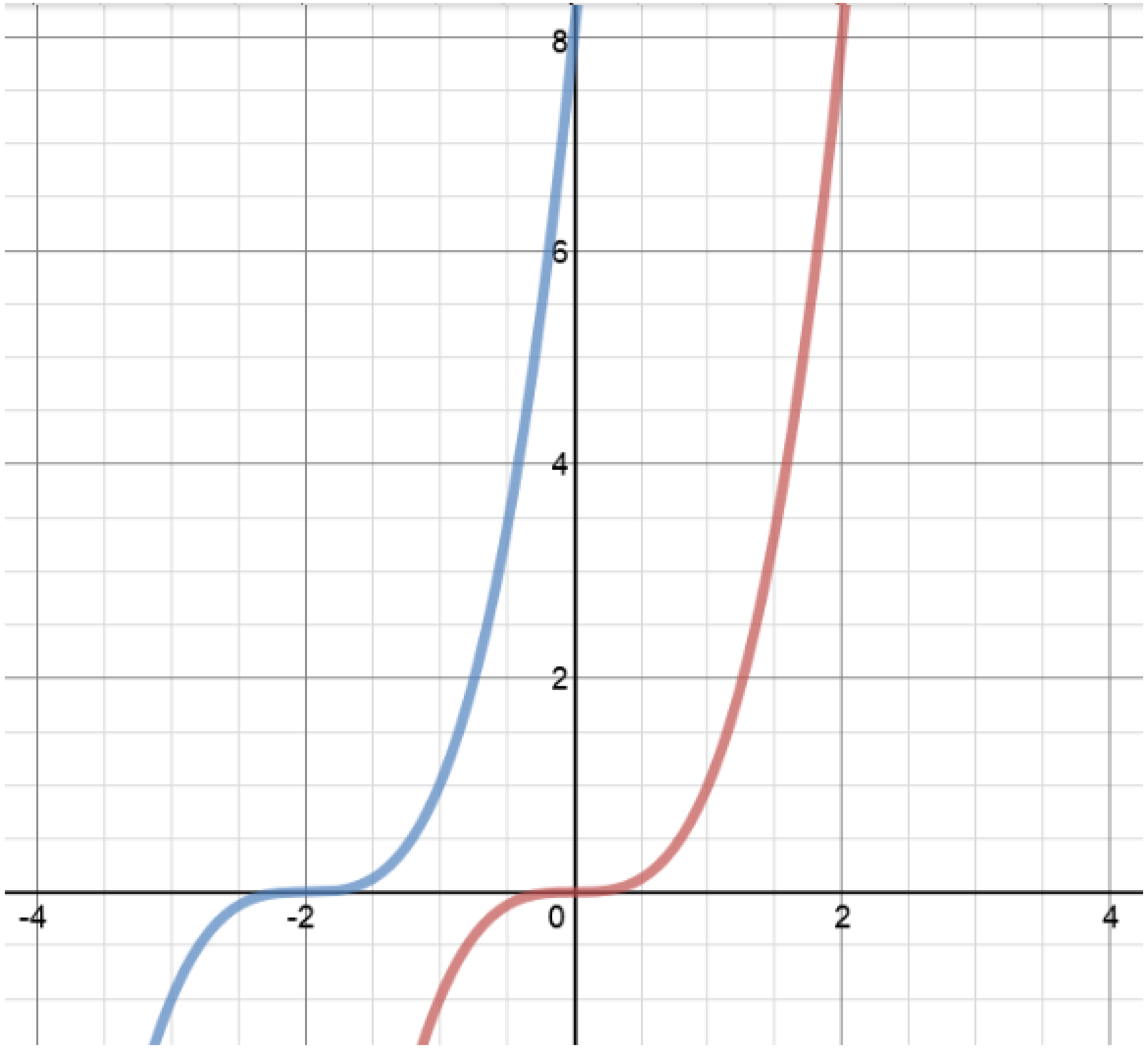
$$g(x) = (x-1)^2$$



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.

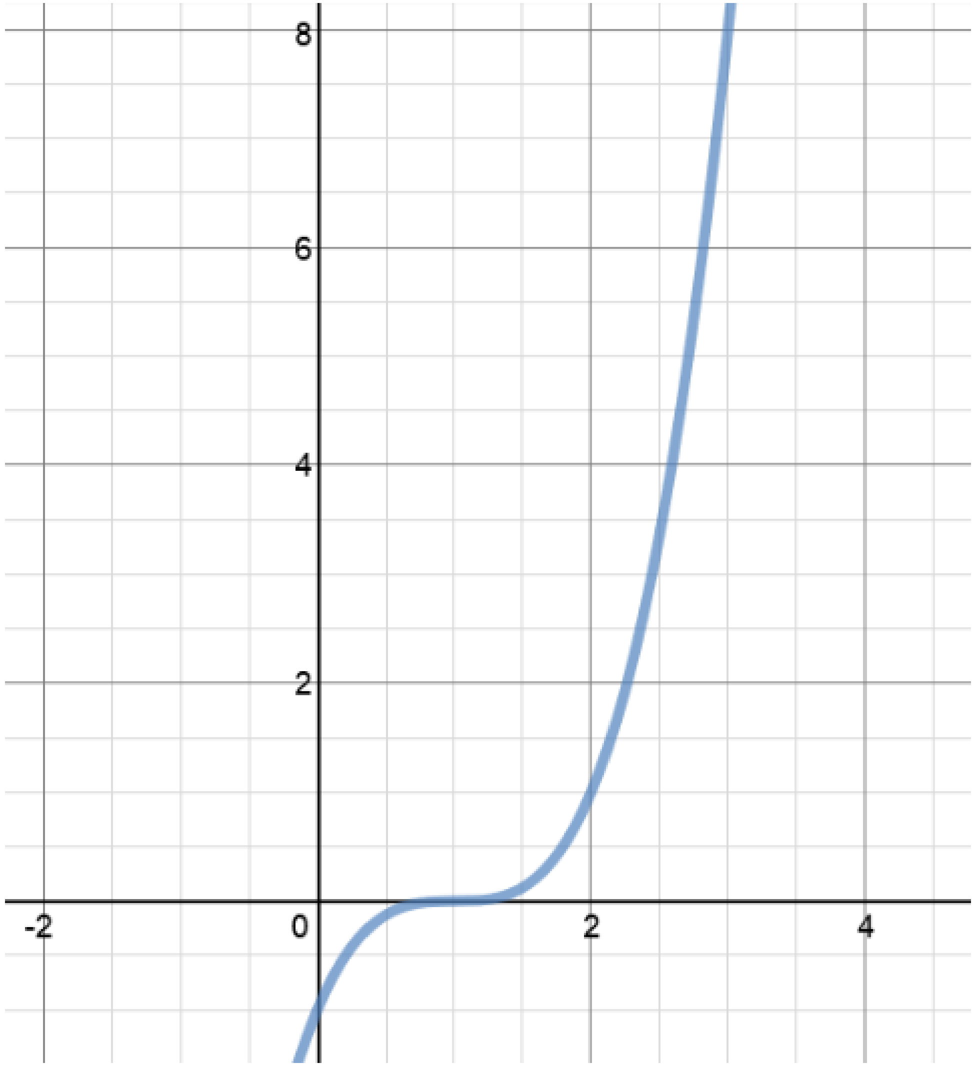
Parent Function? **Cubic, $f(x) = x^3$**

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

Which way did it go? **Left**

By how much? **1 unit**

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



Transformations

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

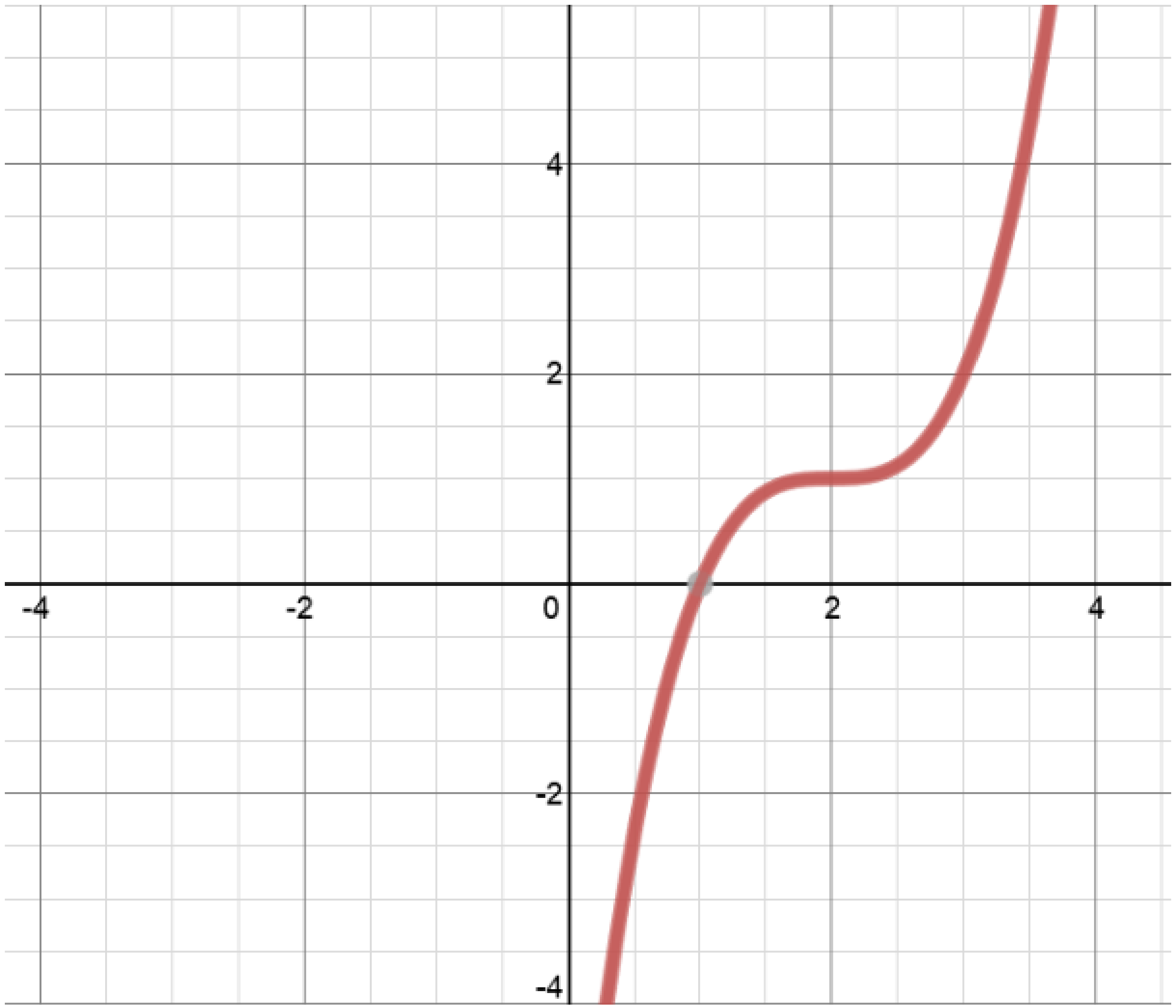
$f(x) = (x-2)^3+1$

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**.

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

How do we interpret this function notation?

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

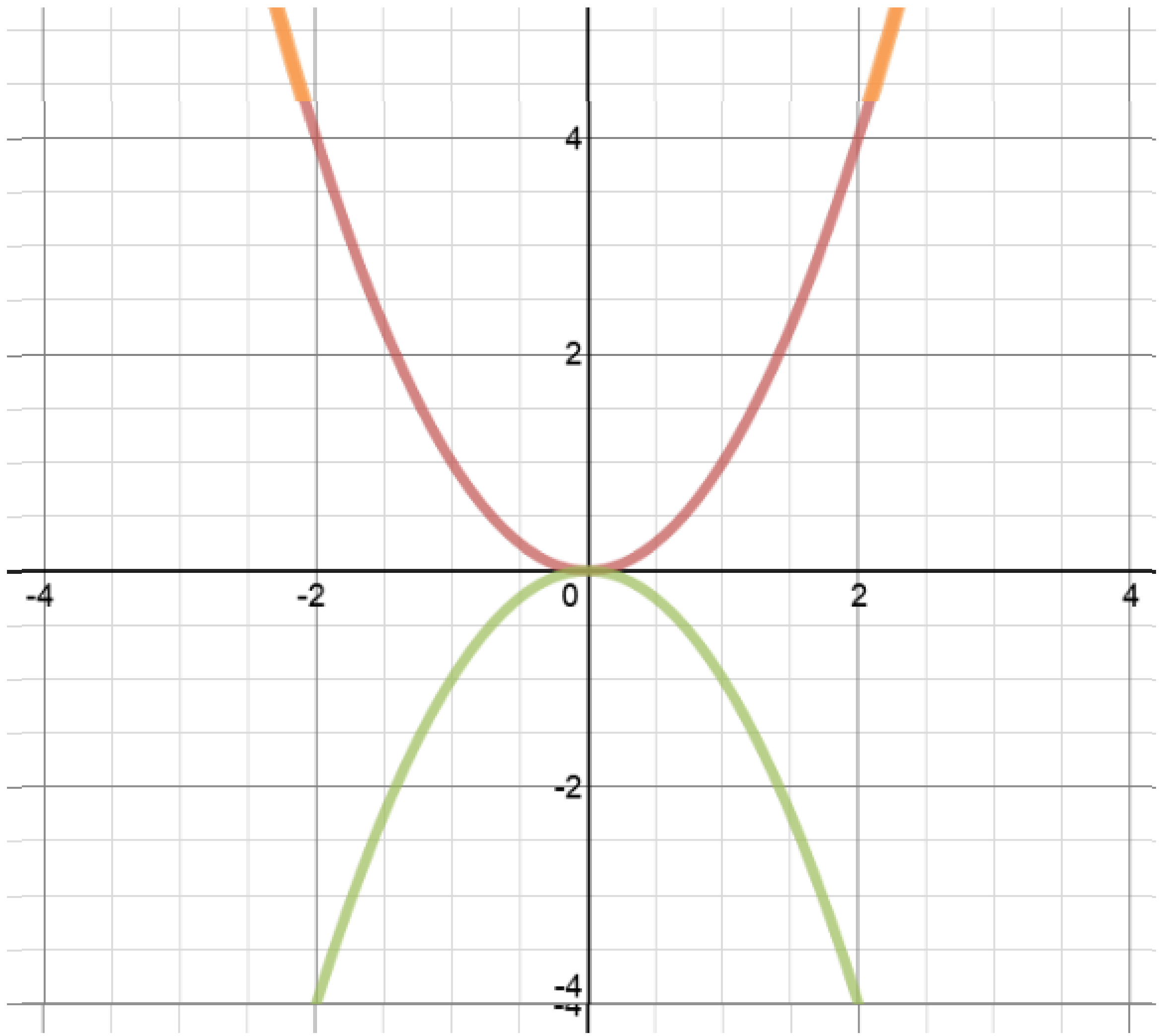
Let $f(x) = \sqrt{x}$, then $-f(x) = -\sqrt{x}$

Transformations

Flip across the x axis

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

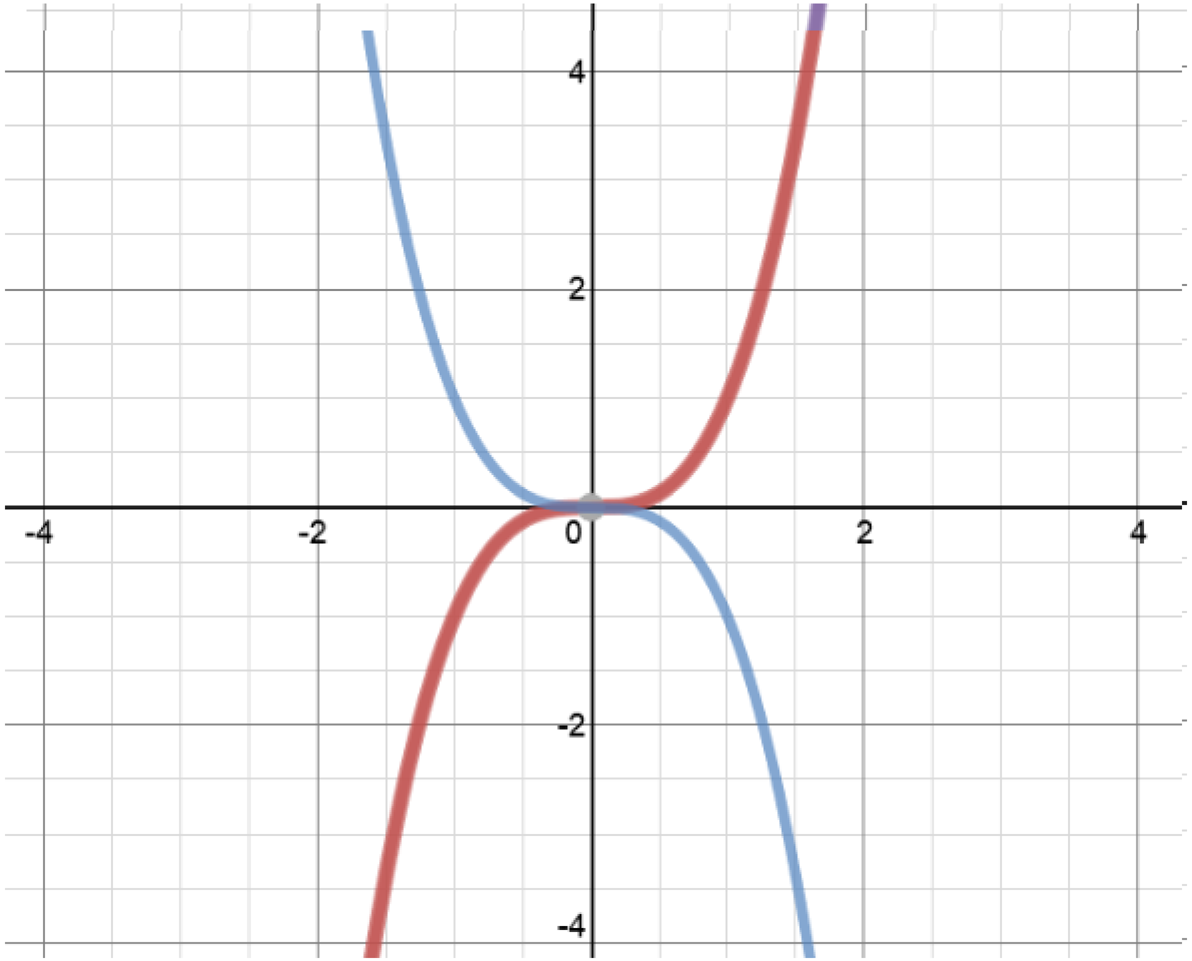
X	X^2	$-X^2$
3	9	-9
2	4	-4
1	1	-1
0	0	0
-1	1	-1
-2	4	-4
-3	9	-9



Flip 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.

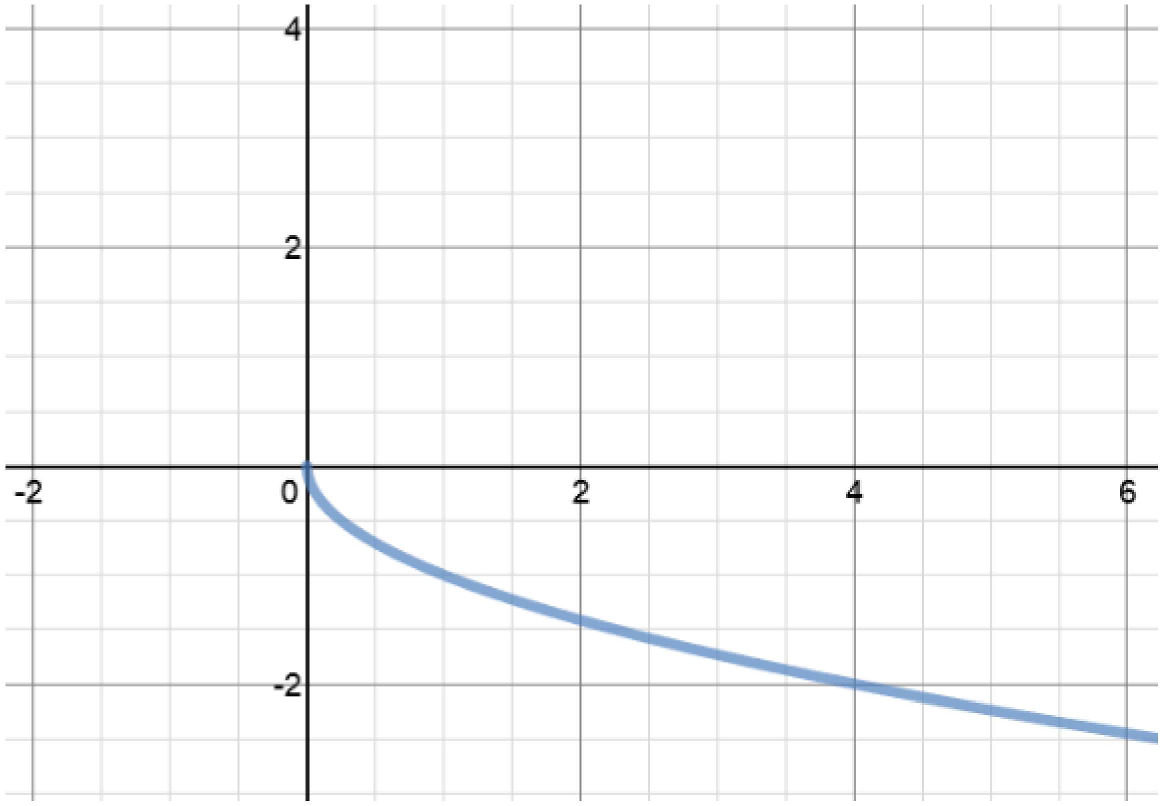
Parent Function? **Radical,** $f(x) = \sqrt{x}$

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

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

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

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



Transformations

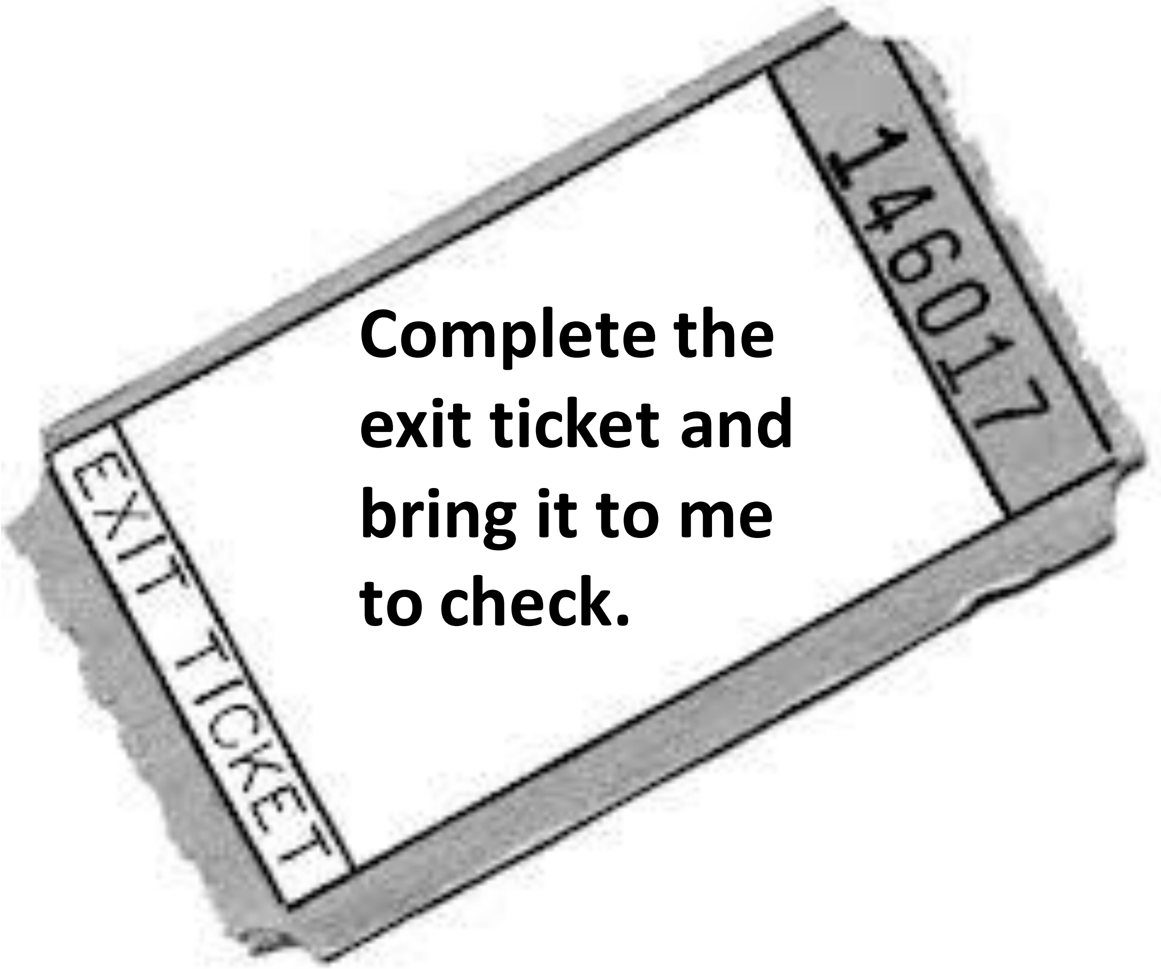
Summary of the Rigid Transformations

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
$g(x) = -f(x)$	Flipped over the x-axis

Did we meet our objectives?



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