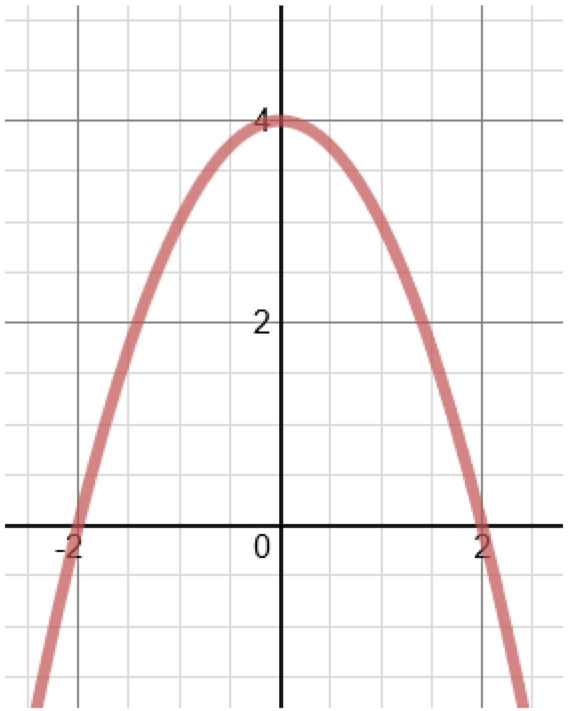
Warm -up

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

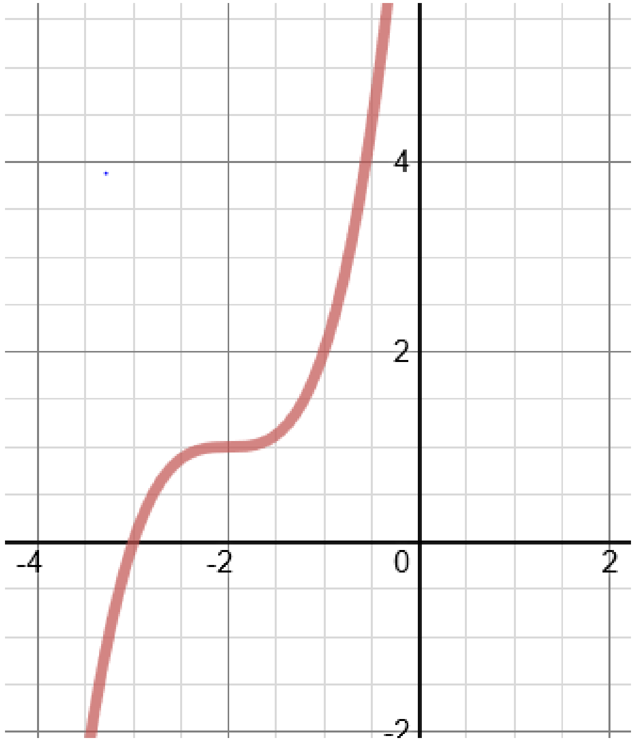


Parent Function:

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

Transformations:

Flipped over x axis
Vertical shift up 4

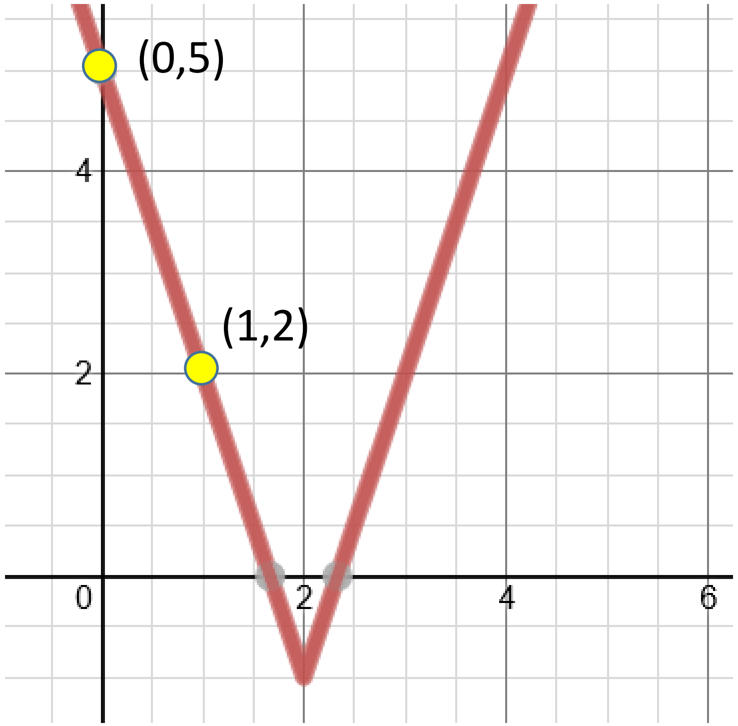


Parent Function:

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

Transformations:

Horizontal shift left 2
Vertical shift up 1



Parent Function:

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

Transformations:

Right 2, Down 1
Vertical stretch by factor of ?

About your QUIZZES

Retakes

You may retake the quiz during enrichment.
Maximum score on any retake (Quiz or Test) is 84.

Make Up Quiz

If you have not taken the quiz yet, you may make it up during enrichment.

Additional Help

Tutoring, you need a pass for morning sessions.

I’ve posted videos on the website that may help also.

About your QUIZZES

Name <u>Key</u> DATE________ PERIOD____

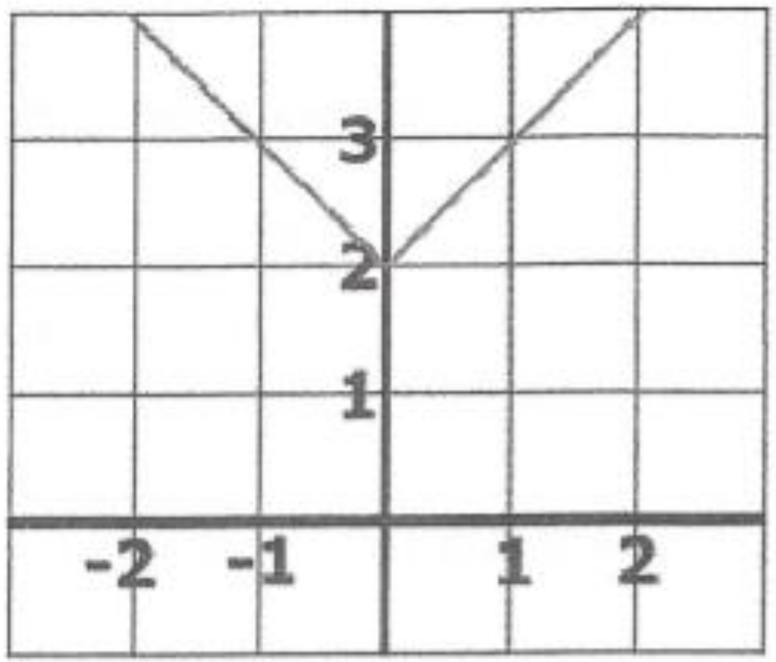
1) Domain: $(-\infty, \infty)$ Range: $[2, \infty)$

Increasing: $(0, \infty)$ Decreasing: $(-\infty, 0)$

As x -> ∞ y-> ∞ As x-> -∞, y-> ∞

Maximum(s): none Minimum(s): $(0, 2)$

x- Intercept(s): none y-intercept(s): $(0, 2)$



About your QUIZZES

2) Sketch the graph of a cubic model that has the following:

up down

End behavior: as x-> - ∞, y -> ∞ and as x -> ∞, y -> -∞

Intervals of increase: (-3,5)

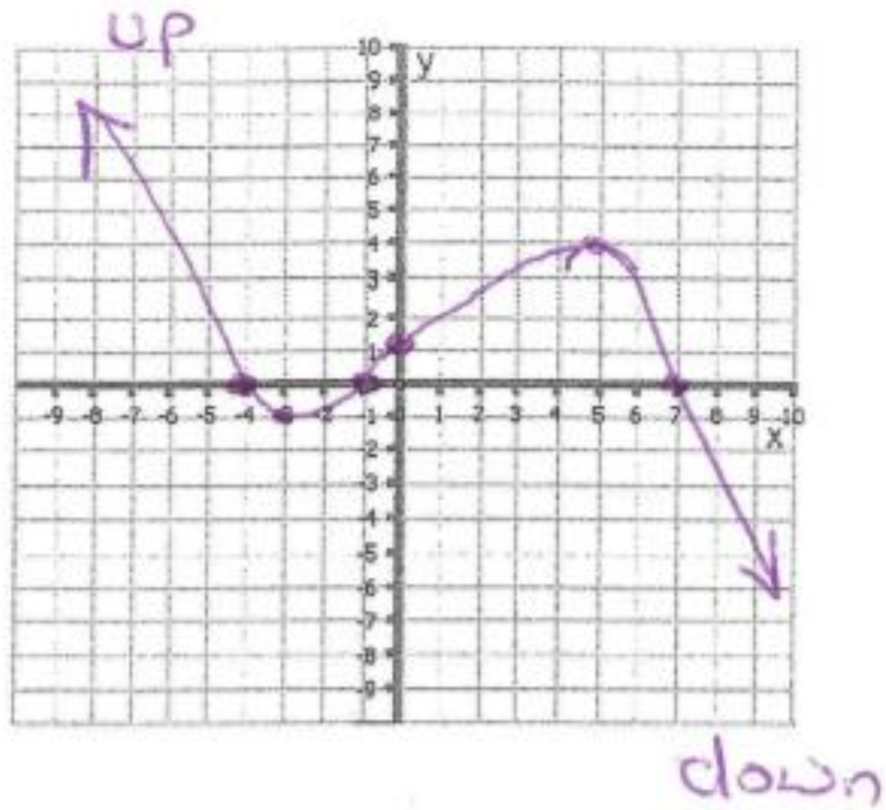
Intervals of decrease: (-∞,-3), (5, ∞)

Relative maximum: (5,4)

Relative minimum (-3,-1)

x-intercepts: (-4,0),(-1,0), (7,0)

y-intercept: (0,1)



Objectives for today

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.

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

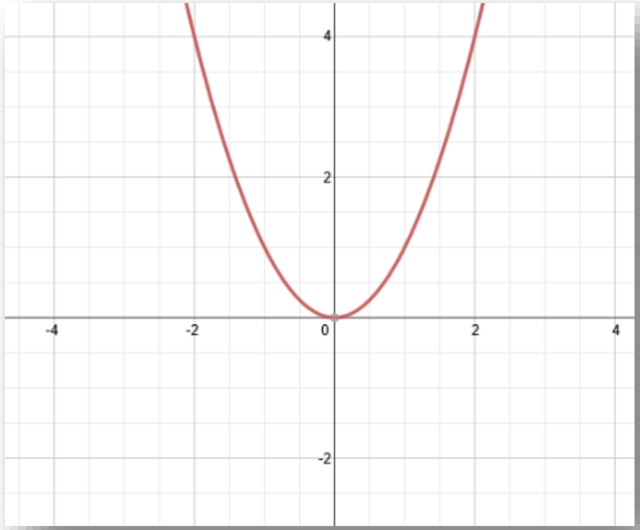
Function Notation	Description of Transformation
$g(x) = f(x \pm c)$	Horizontal shift **left** C units if C is **positive**.
	Horizontal shift **right** C units if C is negative

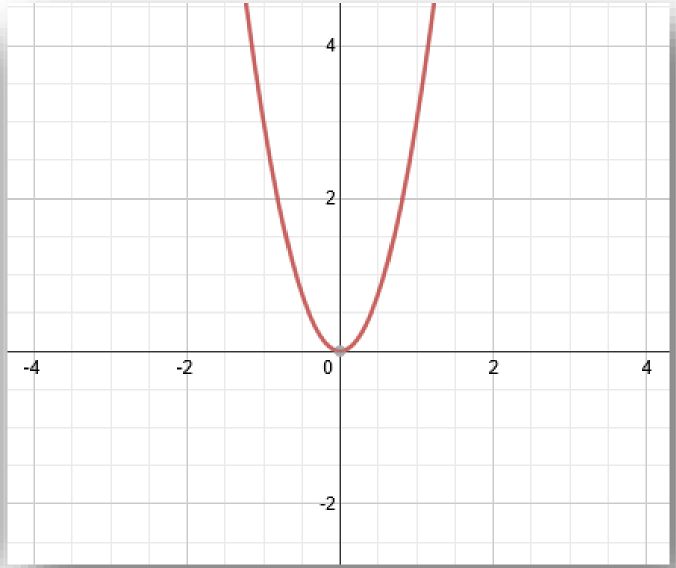
Reflections

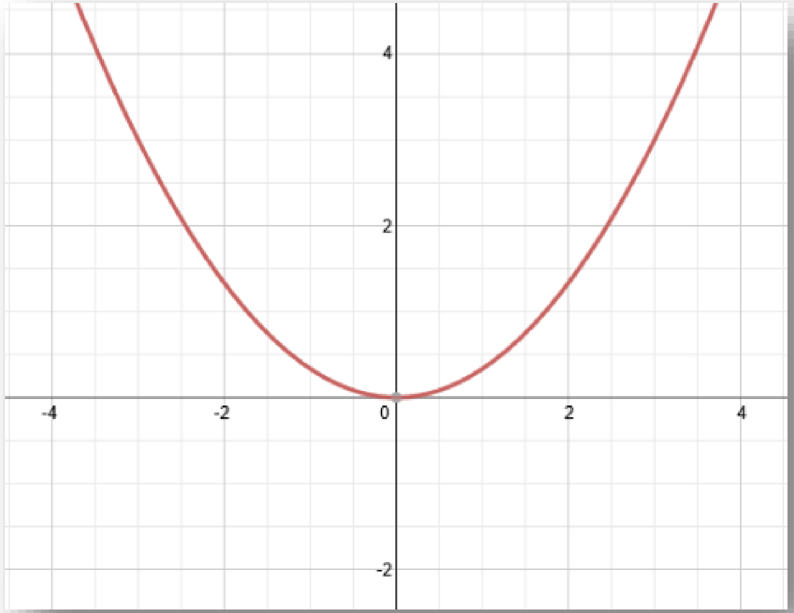
Function Notation	Description of Transformation
$g(x) = -f(x)$	Reflected over the **x-axis**
$g(x) = f(-x)$	Reflected over the **y-axis**

Transformations

Stretching and Compressing a function.







Parent Function

Quadratic

$f(x)=x^2$

Transformed Function

Vertical stretch

Transformed Function

Vertical compression

Transformations

Vertical Stretches and Compressions

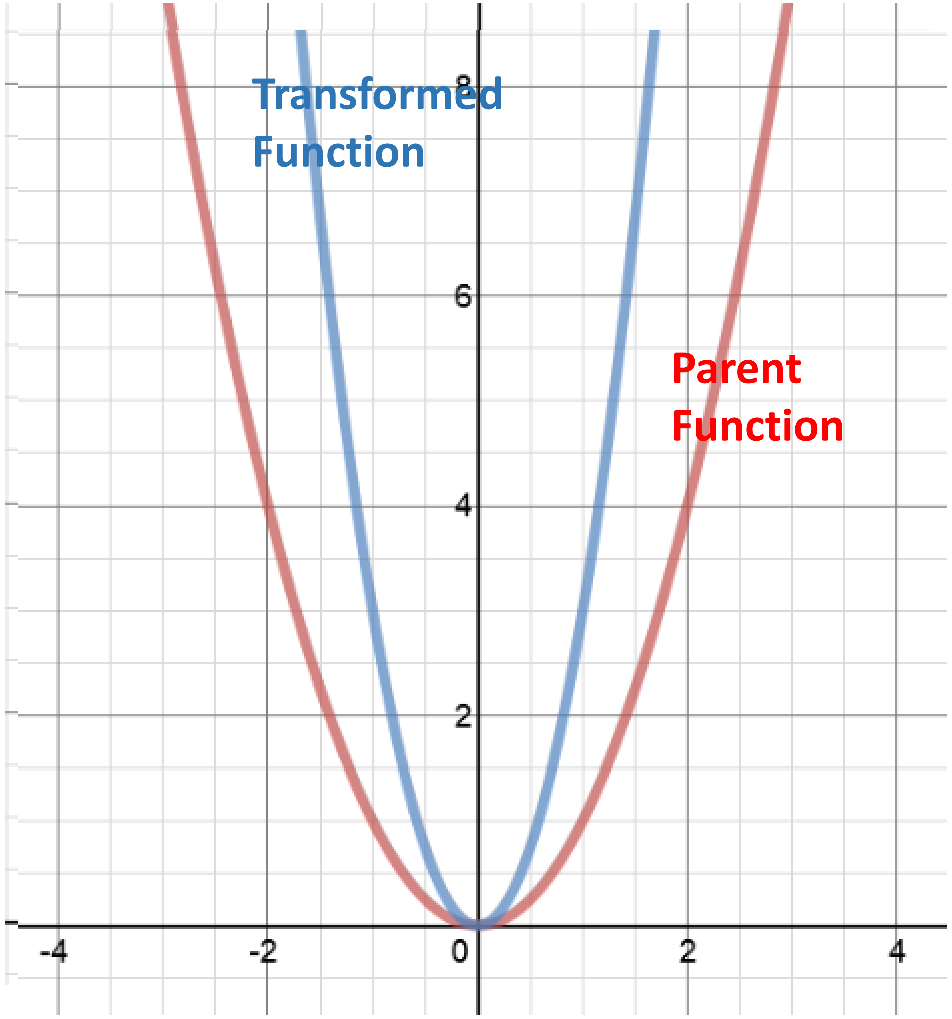
Function Notation	Description of Transformation
$f(x) = cf(x)$	Vertical **Stretch** if $\boldsymbol{c > 1}$
	Vertical **Compression** if $\boldsymbol{0 < c < 1}$

Transformations

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

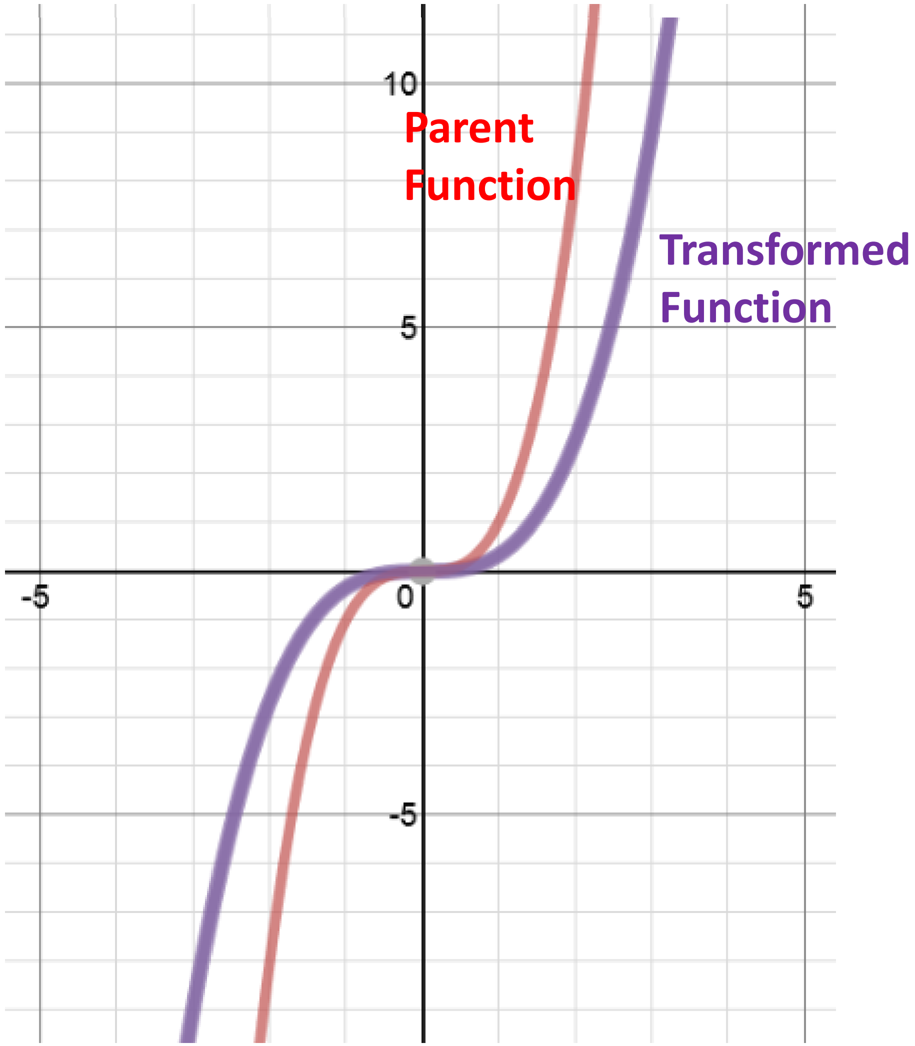


Transformations

What’s going to happen to the parent function?

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

x	$y = x^3$	$y = \frac{1}{3}x^3$
3	27	9
2	8	$^8/_3$
1	1	$^1/_3$
0	0	0
-1	-1	$^{-1}/_3$
-2	-8	$^{-8}/_3$
-3	-27	-9



Transformations

Look at your "Pulling it all together" worksheet

Standard form of a transformation $g(x) = af(x - h) + k$

Examples

Quadratic	Cubic	Exponential
$y = a(x-h)^2 + k$	$y = a(x-h)^3 + k$	$y = a2^{x-h} + k$

Vertical stretch if **a** > 1, compression if 0 < a < 1 6) describe the effect of **a** on the graph.

Horizontal shift right if **h** is negative and left if **h** is positive 7) describe the effect of **h** on the graph.

Vertical up if **k** is positive and down if **k** is negative 8) describe the effect of **k** on the graph.

This form of an equation is also called vertex form.

$$g(x) = a\,f(x-h) + k$$

When an equation is in this form, the vertex is always (h, k).

$g(x) = 4(x-3)^2 + 7$	Vertex (3,7)
$g(x) = (x+13)^3$	Vertex (-13,0)
$g(x) = \sqrt{x-2} - 5$	Vertex (2,-5)
$g(x) = 0.5\lvert x\rvert + 8$	Vertex (0,8)

Transformations

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?

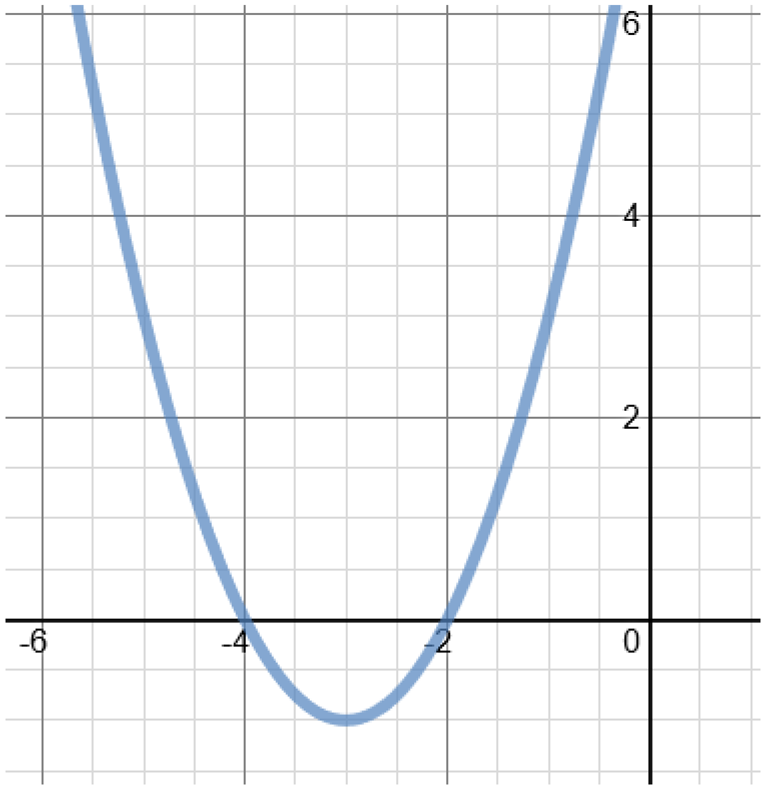
Horizontal shift left 3 units

Vertical shift down 1

Write an equation from what we know.

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

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



Transformations

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

Parent Function?

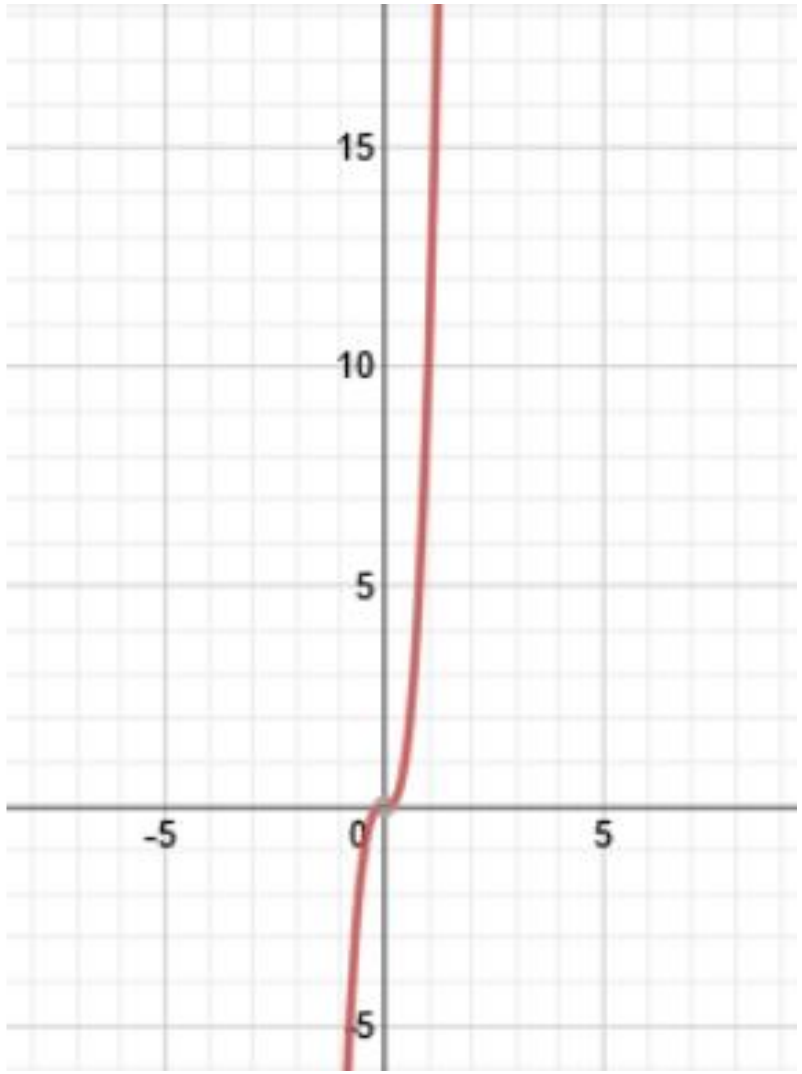
Cubic, $f(x) = x^2$

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

Increasing
Centered at (0,0)

How is it different from the parent graph?

No vertical or horizontal shifts.
No Flip.
Vertical stretch.



Transformations

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

Find a point on this graph.

$(1{,}10)$

Create an equation from what we know.

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

$$g(x) = 10$$
$$x = 1$$
$$h = 0$$
$$k = 0$$

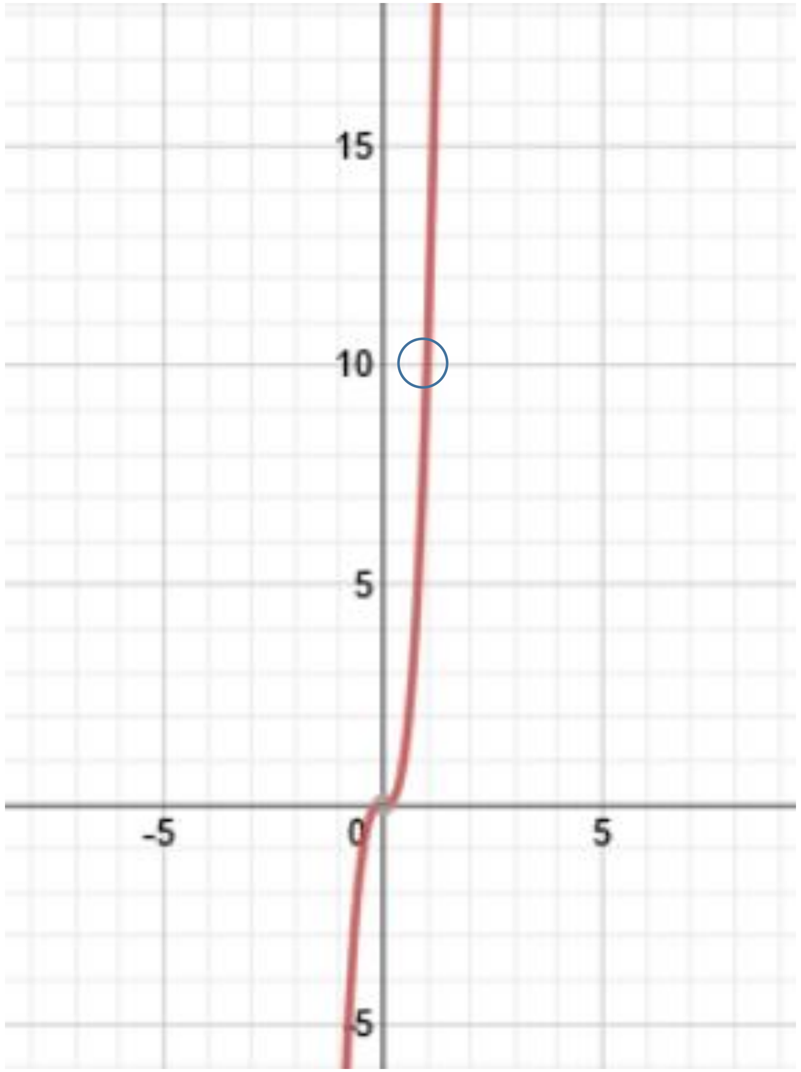
$$10 = a(1-0)^3 + 0$$

Solve for the stretch factor.

$$10 = a$$

Write the equation of the function.

$$g(x) = 10x^3$$



Transformations

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

Parent Function?

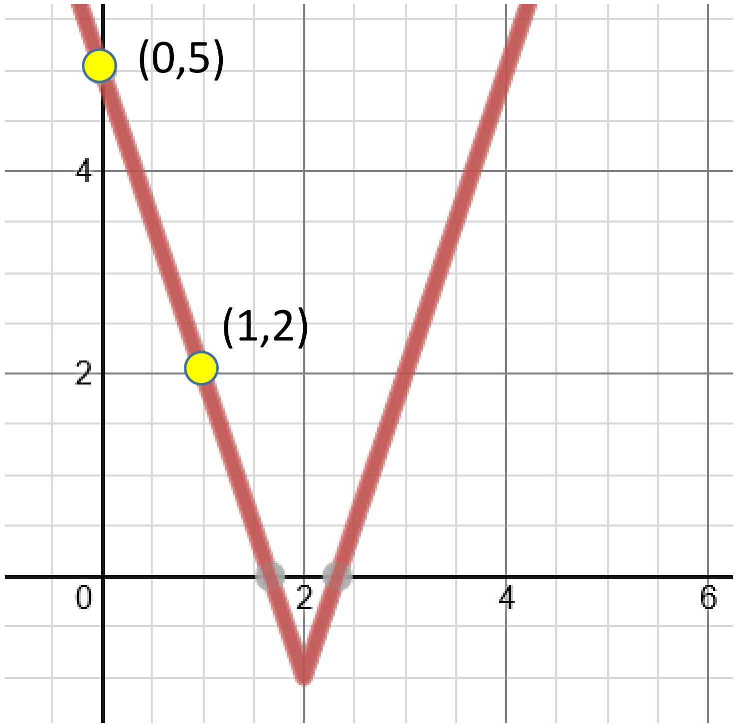
Absolute Value, $f(x) = |x|$

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.



Transformations

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.

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

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

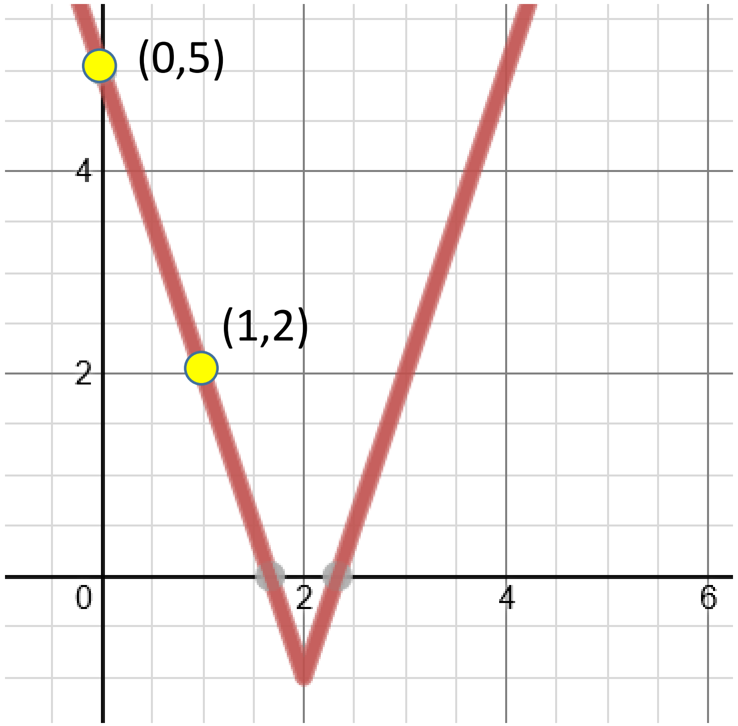
$$5 = a|0 - 2| - 1$$

Solve for the stretch factor.

$$2 = a$$

Write the equation of the function.

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



Transformations

Graphing a function from its equation

Think before you graph…

What's the parent function? Cubic, $f(x) = x^3$

Shape of the parent? Centered around origin
Always increasing

Create a T chart AND carefully pick the points you will plot.

x	g(x)
1	-7
2	0
3	1
4	2
5	9

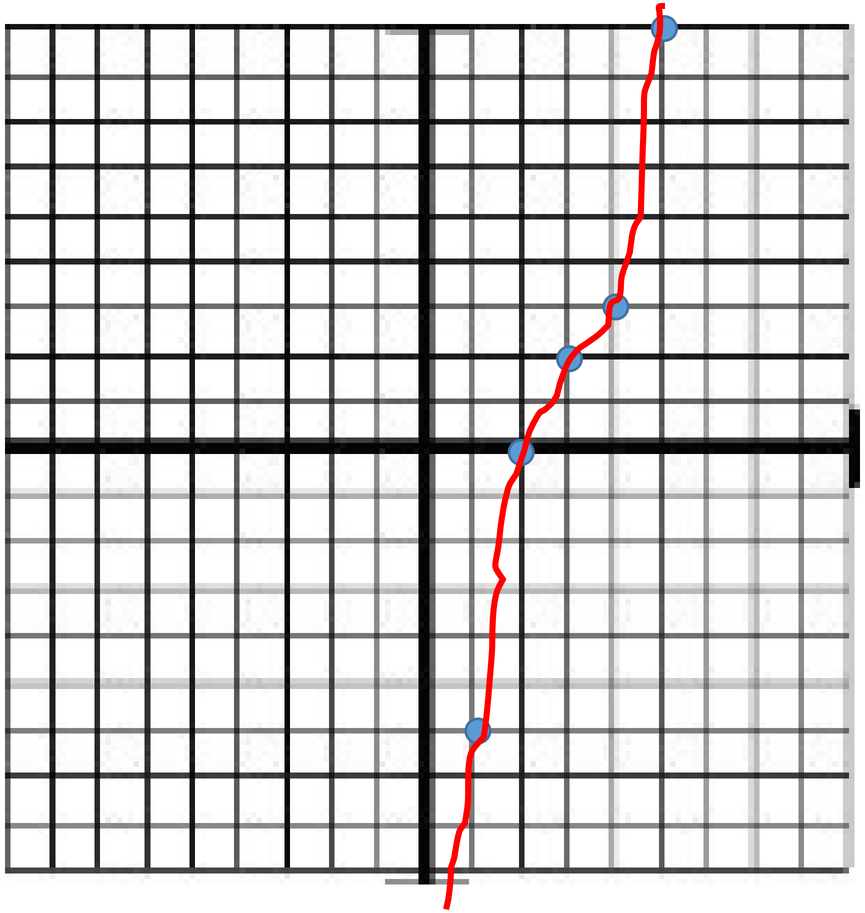
1. Put the center in the middle of the chart.

2. Pick a reasonable number of x values on either side of the center point.

3. Evaluate the function at these x values and plot the points.

4. Connect the dots.

Graph the function $g(x) = (x-3)^3+1$



Transformations

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

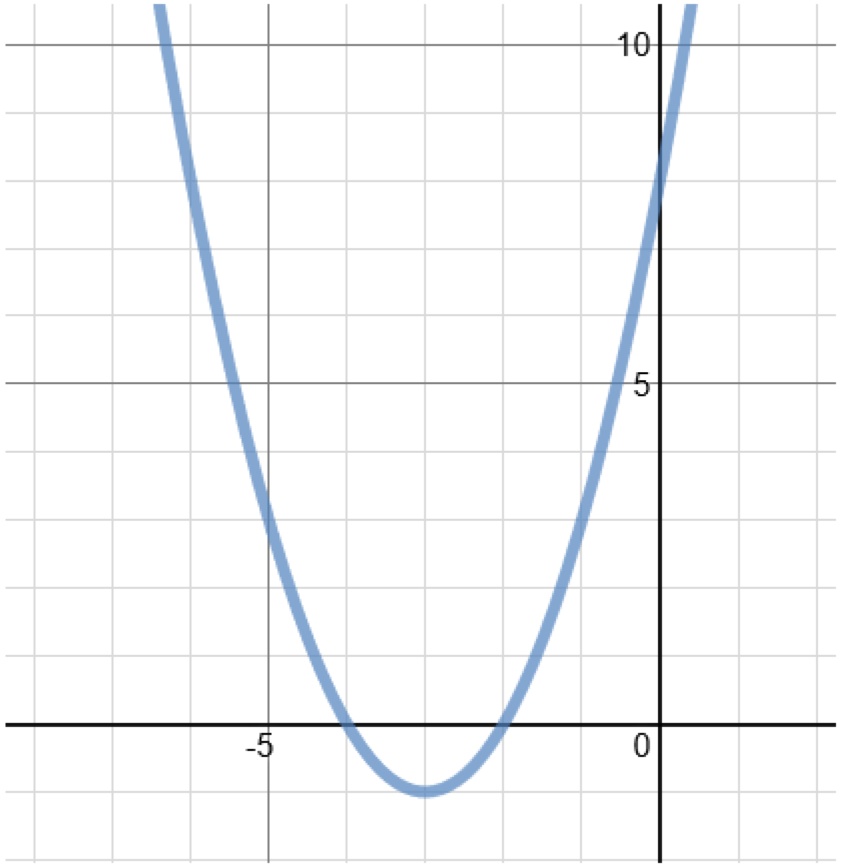
The function pictured is $f(x) = (x+3)^2 - 1$

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



Transformations

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

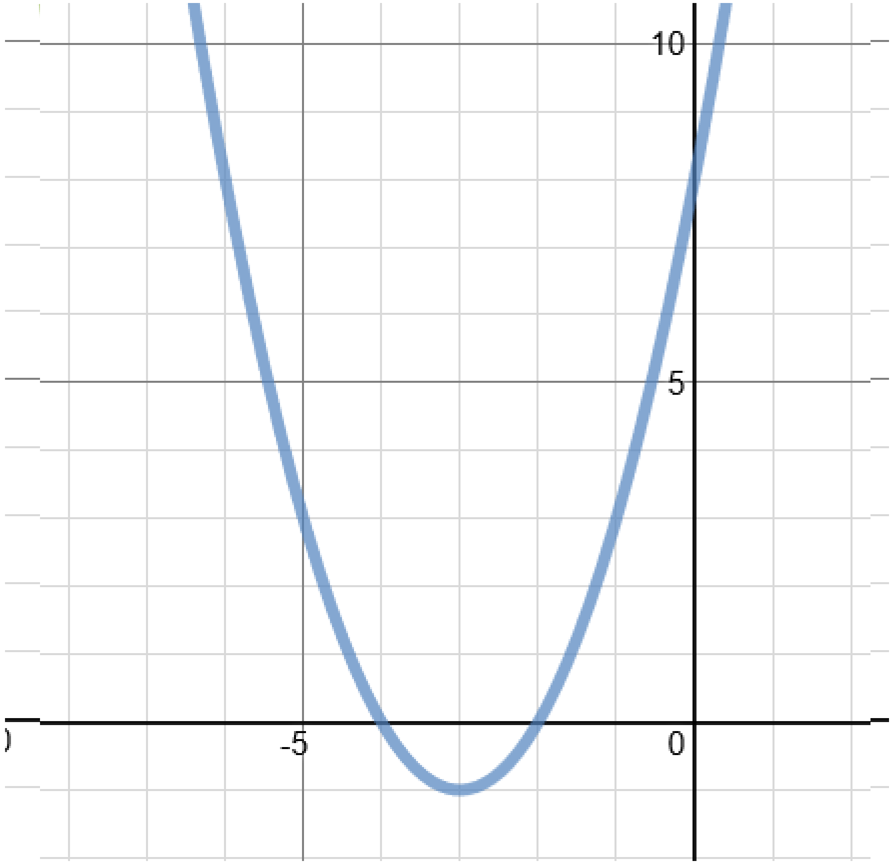
The function pictured is $f(x) = (x+3)^2 - 1$

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 $g(x) = (x+6)^2 - 1$



On the Transformations – Pulling it all together worksheet...

The following are transformations of the functions you graphed in problems 14-17.

14.a. Write the new function that would be created if the function $y = (x+2)^2 - 3$ is shifted right 1 unit and up 3?

15.a. Write the new function that would be created if the function $y = -2|x-3| + 2$ is vertically stretched by a factor of 3 shifted down 1 unit?

16.a. What transformations would change the function $y = 4x + 5$ to $y = -x$?

17.a. What transformations of $y = (x+2)^2 - 3$ yield the function y $= -\frac{1}{2}(x-1)^2 + 9$?

What do you remember about…

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.

I spy functions!