

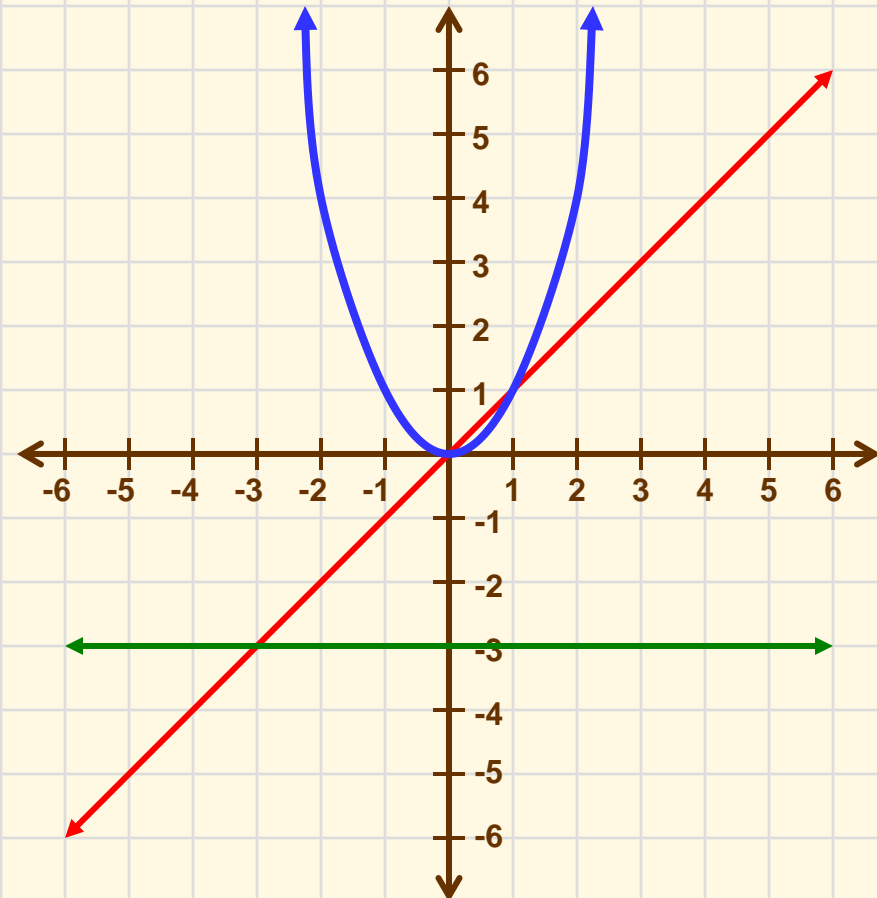
Basic Graphs

Knowing the graphical representation of basic functions allows us to make alterations or transformations into similar (but more complicated) functions

- Let's examine the graphs of some common and basic functions

x	$f(x) = x$	$f(x) = x^2$	$f(x) = -3$
-2	-2	4	-3
-1	-1	1	-3
0			
0.5			
1			
2			

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

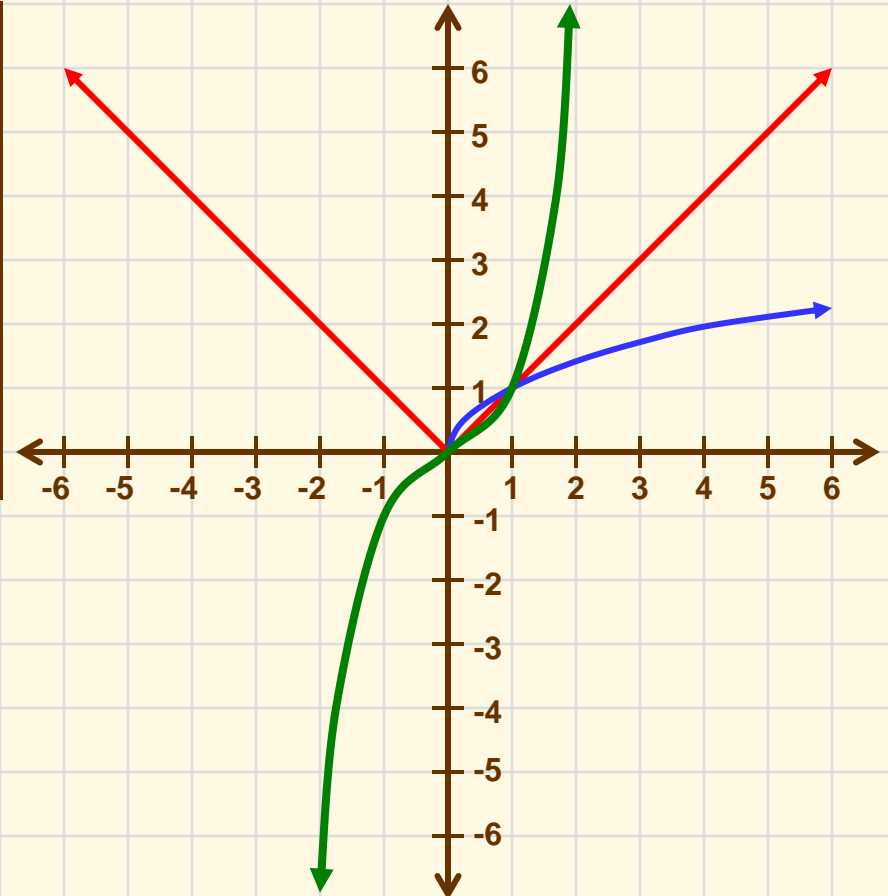


Basic Graphs

Knowing the graphical representation of basic functions allows us to make alterations or transformations into similar (but more complicated) functions

$$f(x) = |x|, f(x) = \sqrt{x}, f(x) = x^3$$

x	$f(x) = x $	$f(x) = \sqrt{x}$	$f(x) = x^3$
-2	2	Not real #	-8
-1	1	Not real #	-1
0			
0.5			
1			
2			

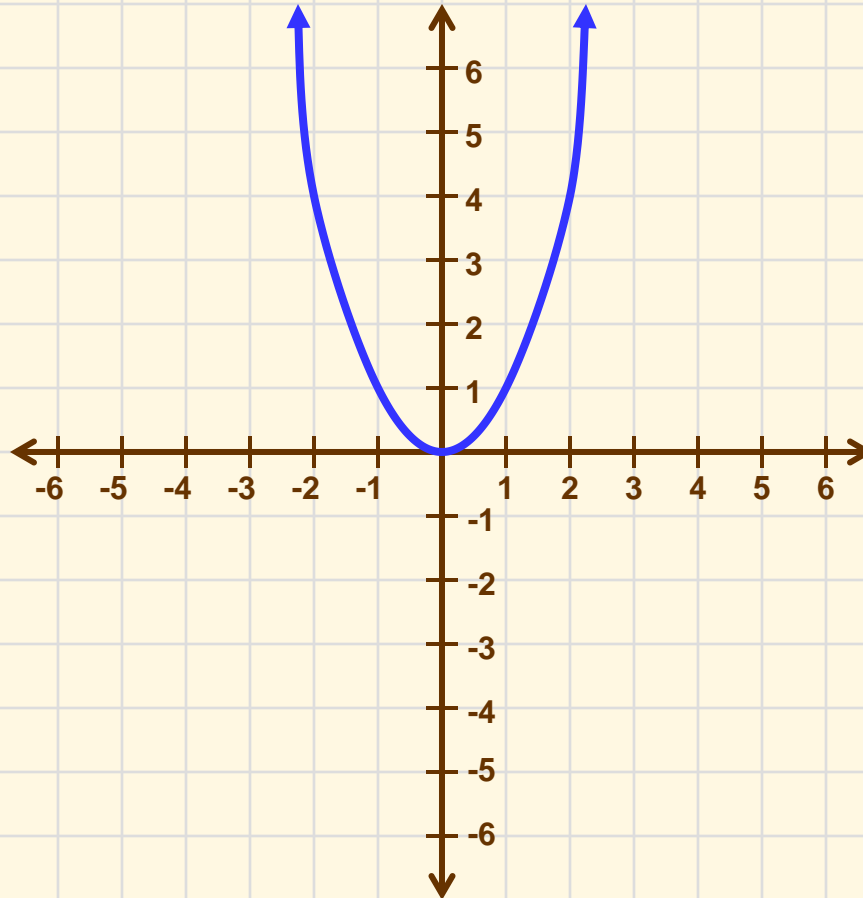


Transformations

- Now let's review some basic transformations and their effects
- Basically, the question becomes what is being affected by the addition / multiplication of a constant
 - The x variable (just the independent variable) \Rightarrow horizontal effect
 - The y variable (or $f(x)$ as a whole) \Rightarrow vertical effect

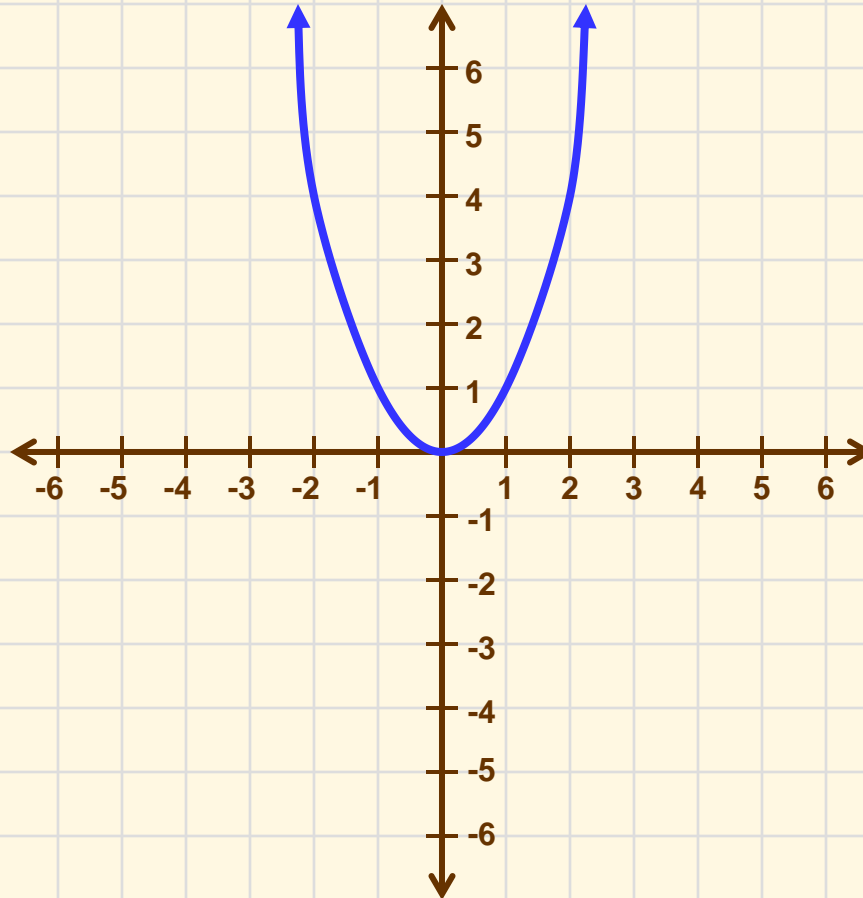
Vertical Shifts

- Vertical shifts (the "y" or entire function is changed by some constant)
 - o The graph of $y = f(x) + c$ is the graph of $y = f(x)$ shifted up vertically by c units
 - o The graph of $y = f(x) - c$ is the graph of $y = f(x)$ shifted down vertically by c units



Horizontal Shifts

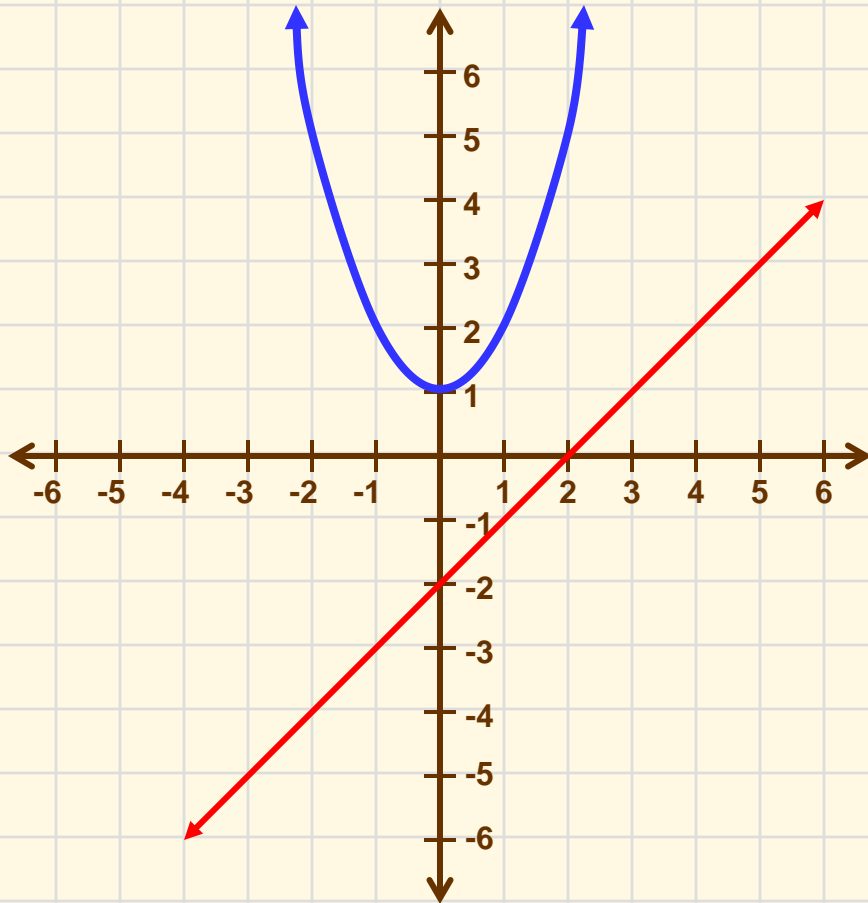
- Horizontal shifts (the "x" or independent variable is changed by some constant)
 - The graph of $y = f(x + c)$ is the graph of $y = f(x)$ shifted to the left (opposite the sign) by c units
 - The graph of $y = f(x - c)$ is the graph of $y = f(x)$ shifted to the right (opposite the sign) by c units



Example Graphs

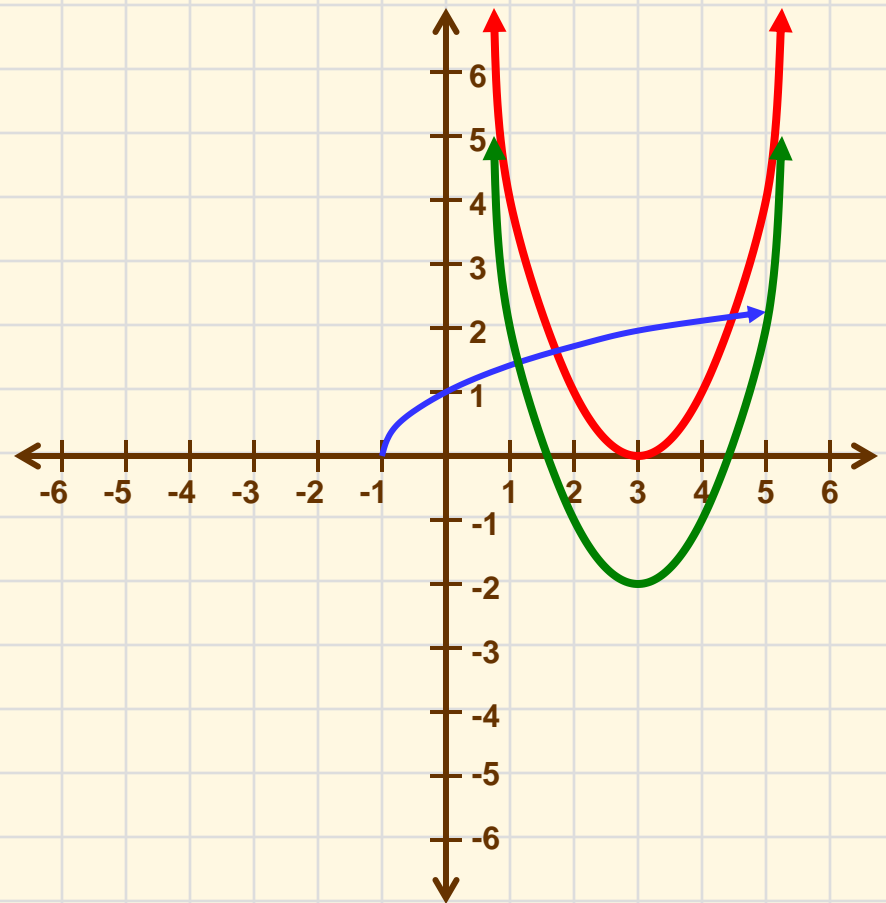
Vertical Shifts

$$f(x) = x - 2, g(x) = x^2 + 1$$



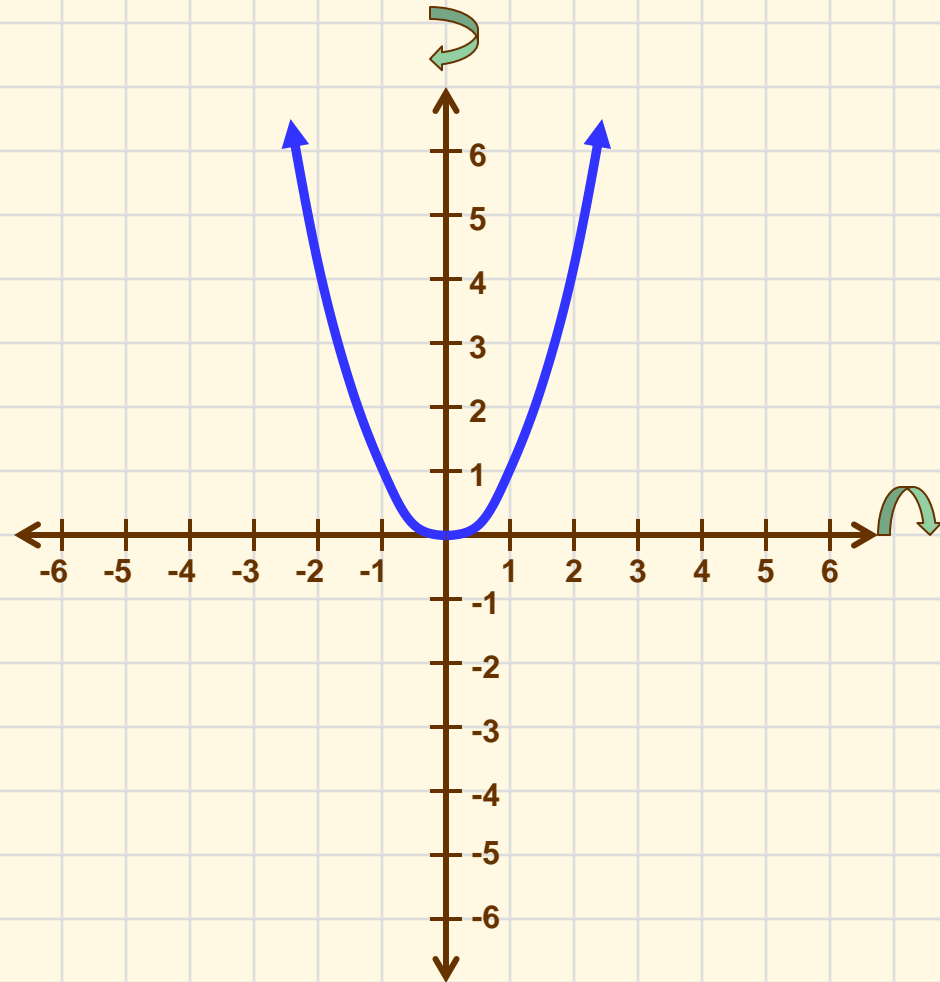
Horizontal Shifts

$$f(x) = (x - 3)^2, g(x) = \sqrt{x + 1}, h(x) = (x - 3)^2 - 2$$



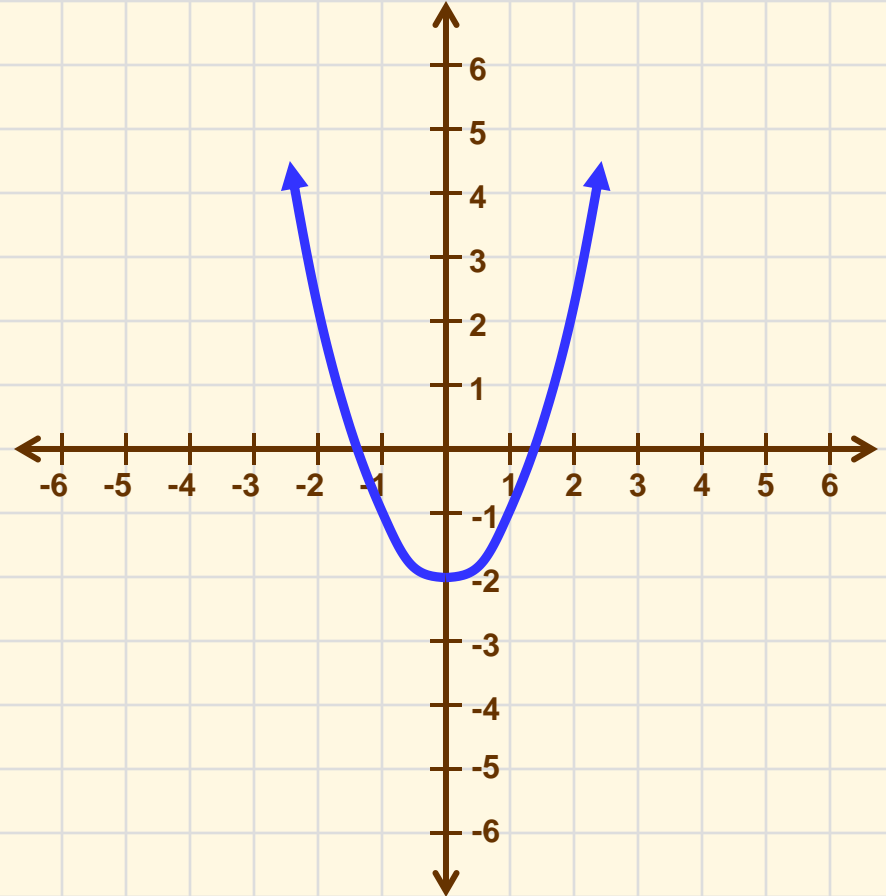
Reflections

- Reflections (graph is the same but reflected about the x / y axis)
 - The graph of $y = -f(x)$ is the graph of $y = f(x)$ reflected about the x-axis (y values are changing)
 - The graph of $y = f(-x)$ is the graph of $y = f(x)$ reflected about the y-axis (we're changing the independent variable x)



Stretching / Shrinking

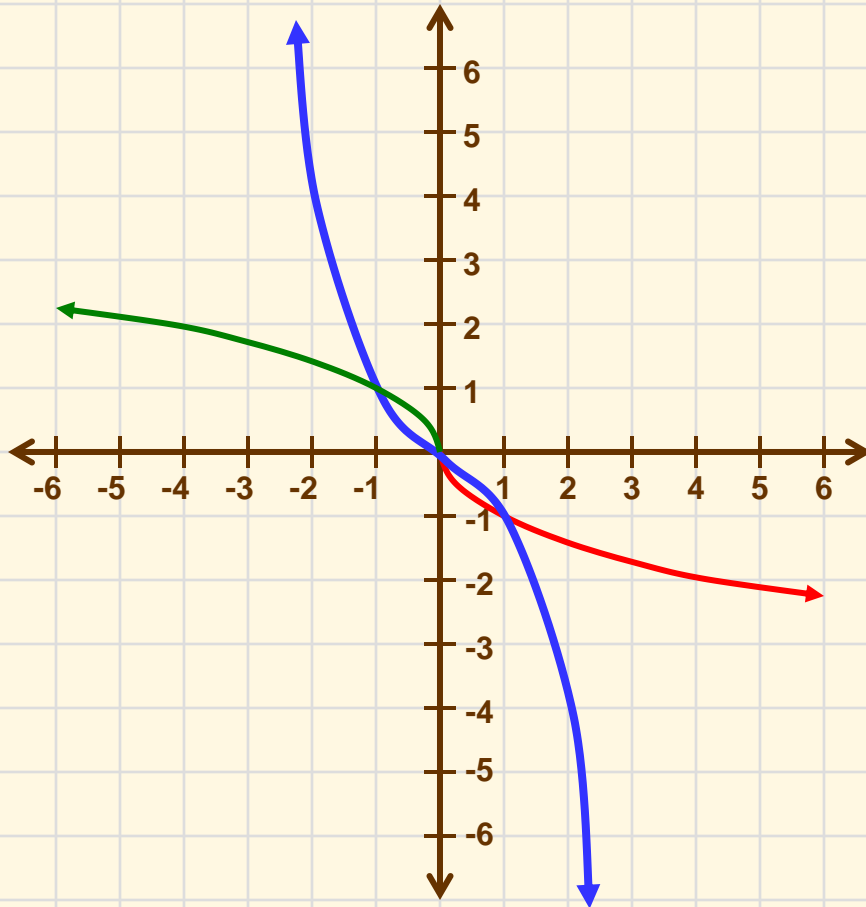
- Stretching / shrinking (graph is the stretched or shrunk vertically / horizontally)
 - The graph of $y = cf(x)$ is the graph of $y = f(x)$ vertically stretched (multiplies y-coordinates by c)
 - Think of grabbing the top and bottom of the graph and stretching it
 - The graph of $y = f(cx)$ is the graph of $y = f(x)$ horizontally stretched (mult. x-coordinates by c)



Example Graphs

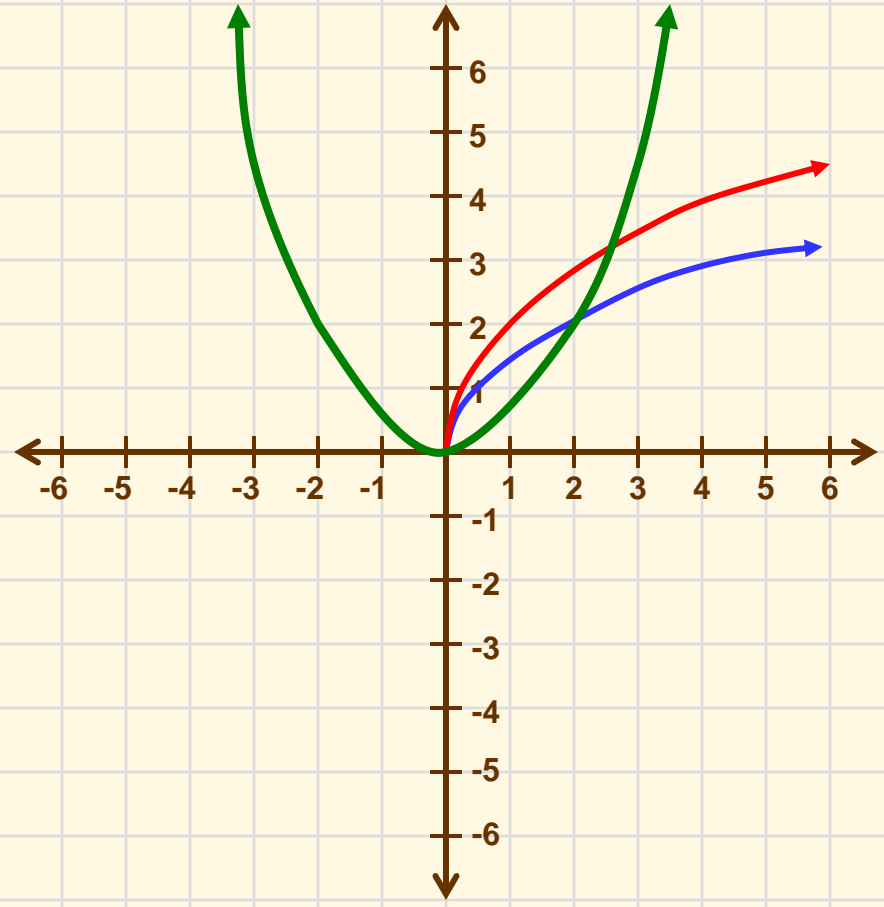
Reflections

$$f(x) = -\sqrt{x}, g(x) = -x^3, h(x) = \sqrt{-x}$$



Stretching / Shrinking

$$f(x) = 2\sqrt{x}, g(x) = \sqrt{2x}, h(x) = \frac{1}{2}x^2$$



Multiple Transformations

Book problems: 53,55,59,63,67,69,77,81,83,87,95,100,103,107,109,115

- These basic transformations can be applied to functions (graphs) individually or in combination with one another
- Look at a couple of HW exercises as an example

