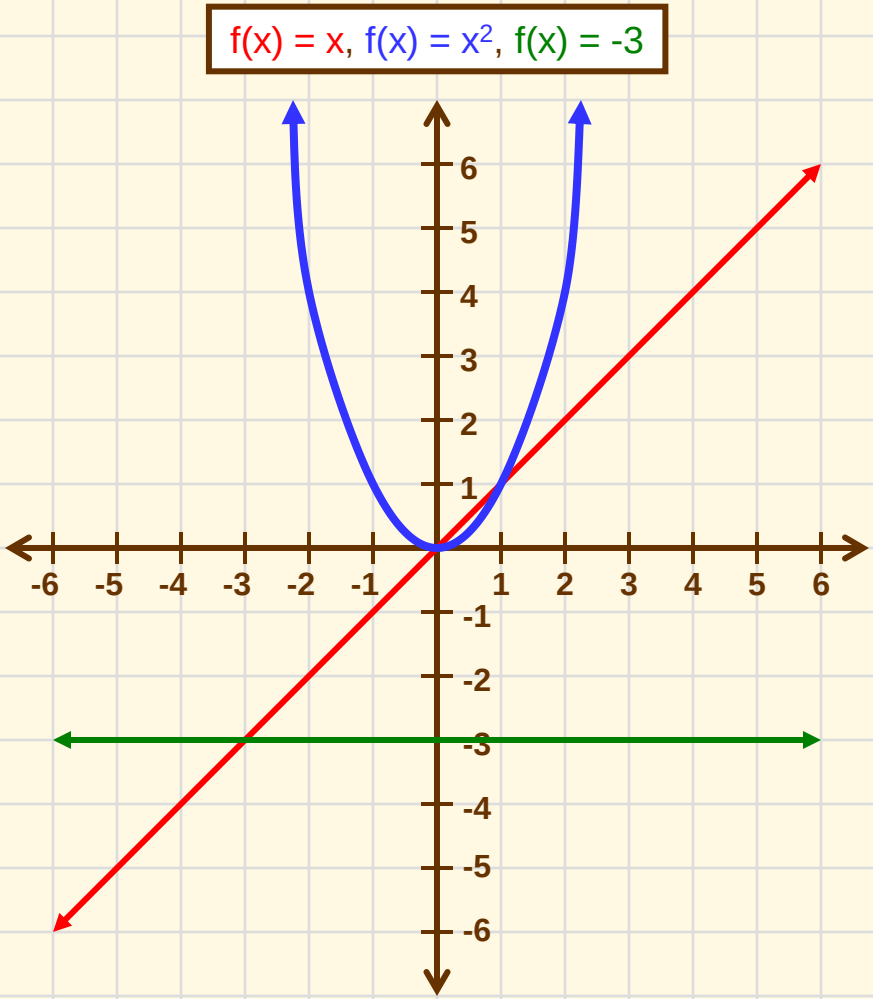
Basic Graphs

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			

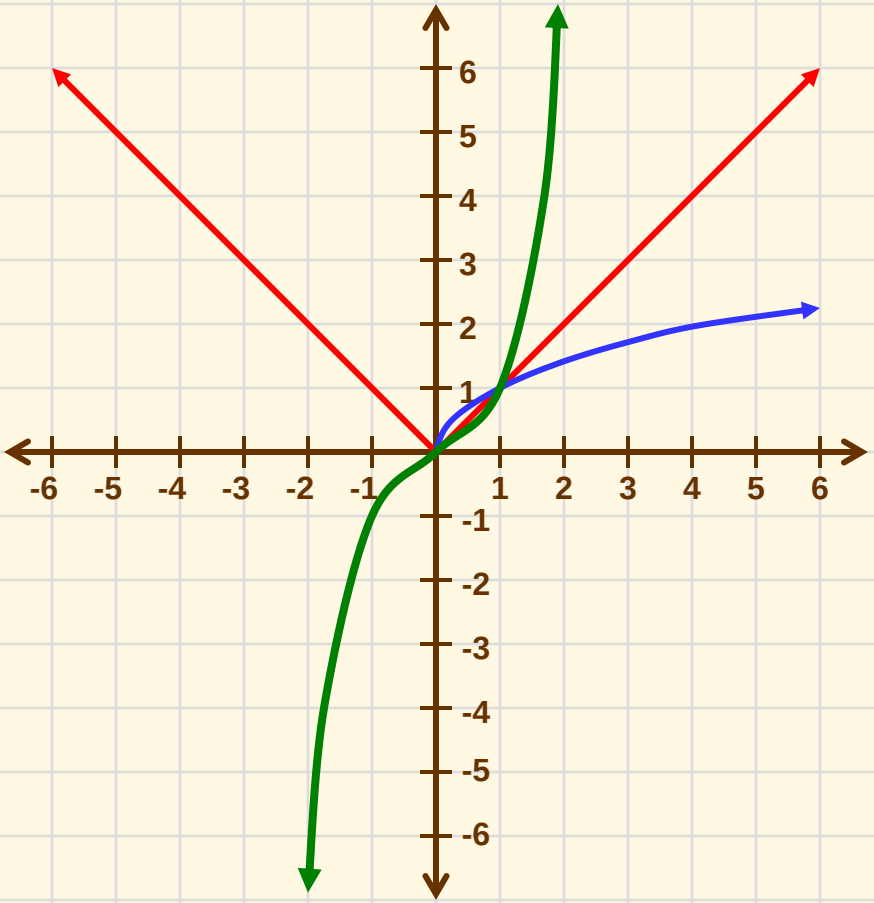


Basic Graphs

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

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			

f(x) = |x|, f(x) = sqrt(x), f(x) = x^3

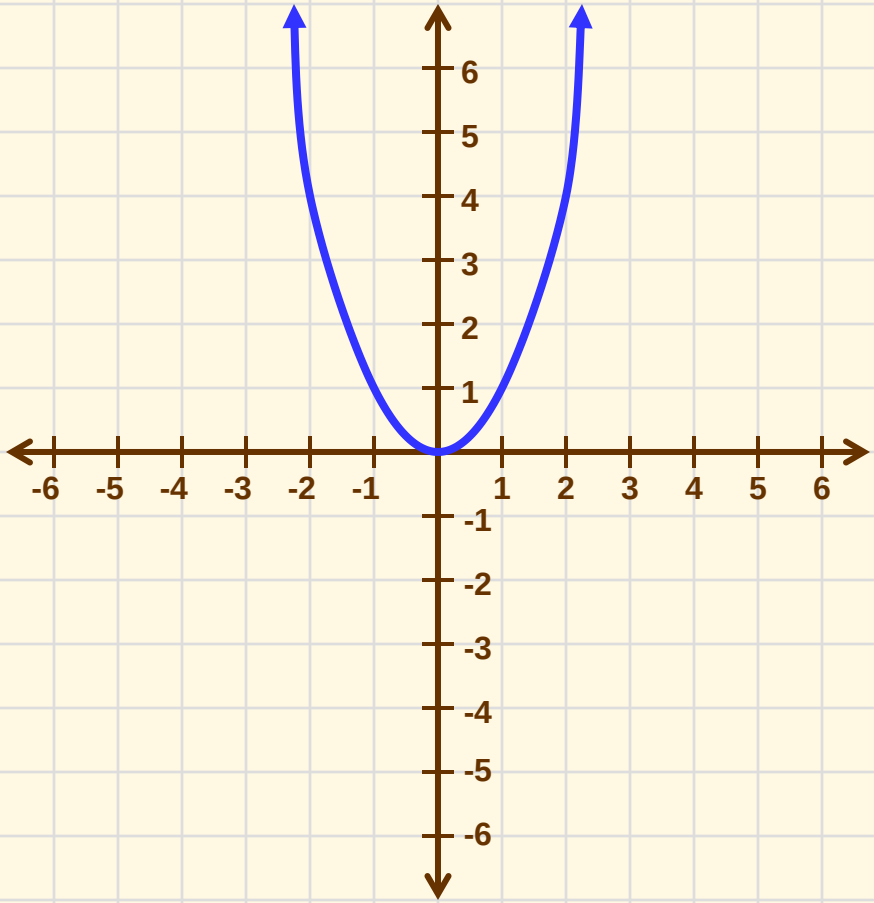


Transformations

- 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) => horizontal effect
  - The y variable (or f(x) as a whole) => vertical effect

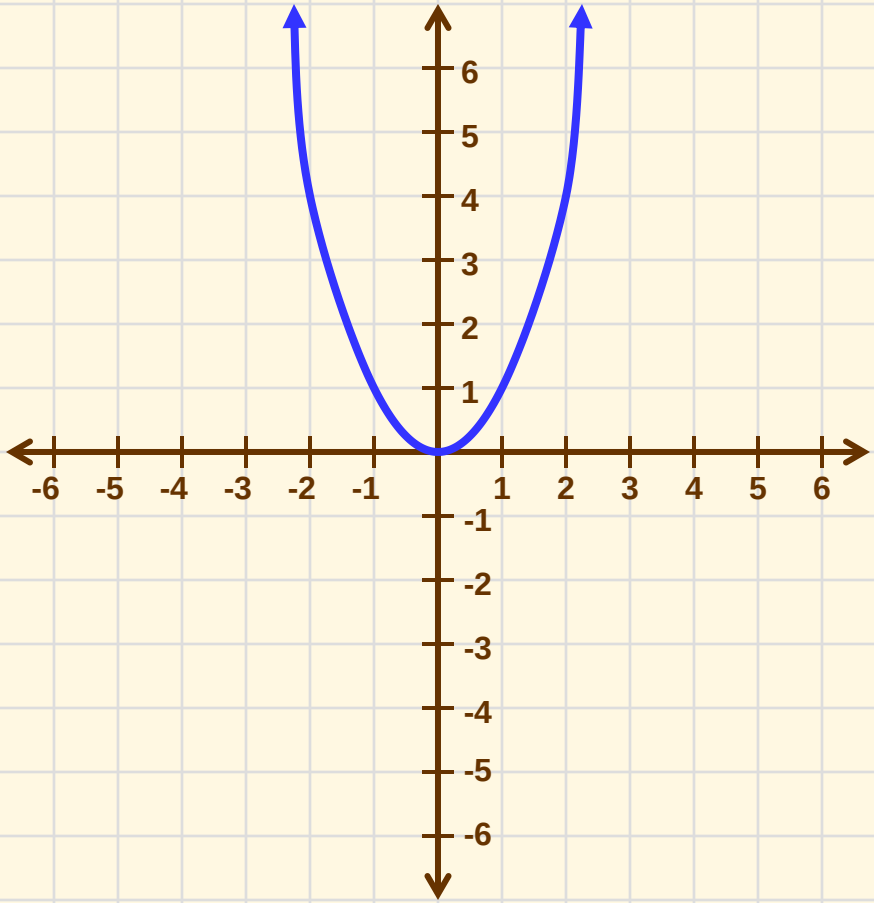
Vertical Shifts

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



Horizontal Shifts

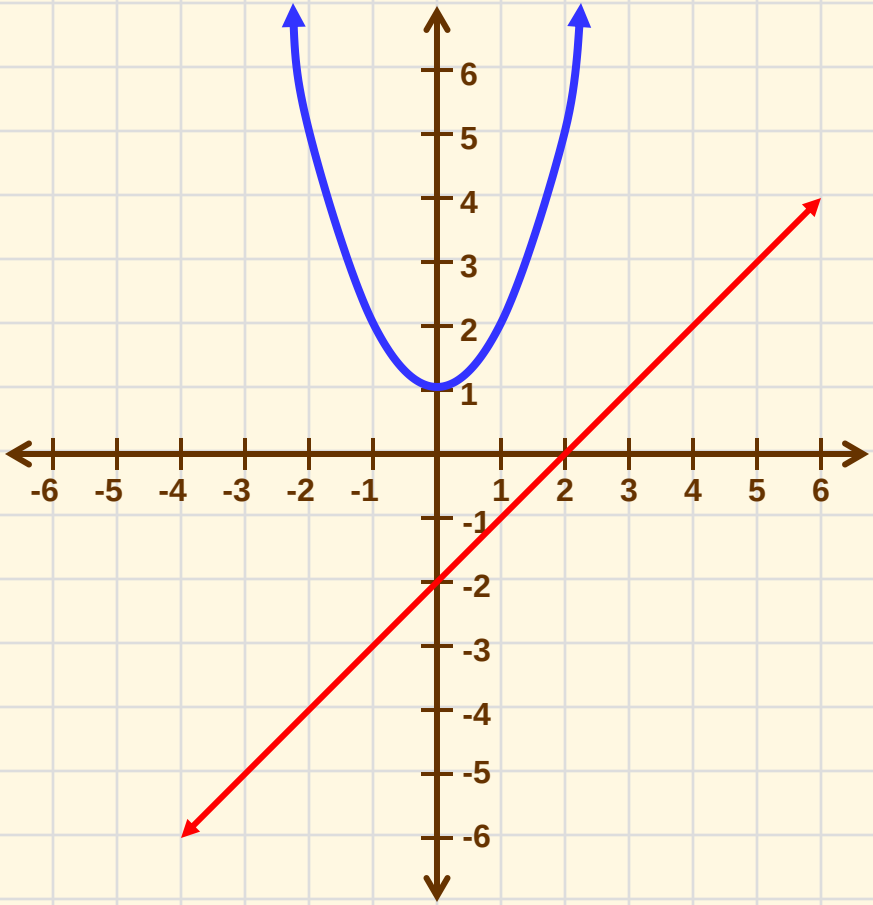
- Horizontal shifts (the “x” or independent variable is changed by some constant)
  - The graph of y = f(x + c) is the graph of y = f(x) shifted to the left (opposite the sign) by c units
  - The graph of y = f(x - c) is the graph of y = f(x) shifted to the right (opposite the sign) by c units



Example Graphs

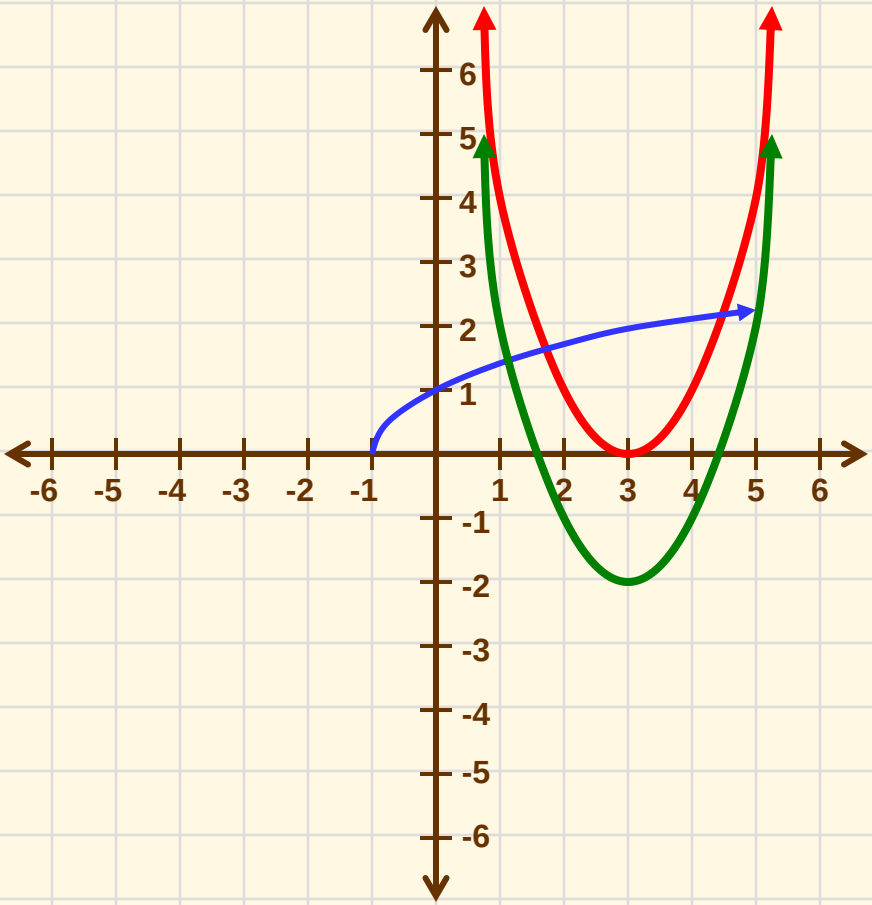
Vertical Shifts

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



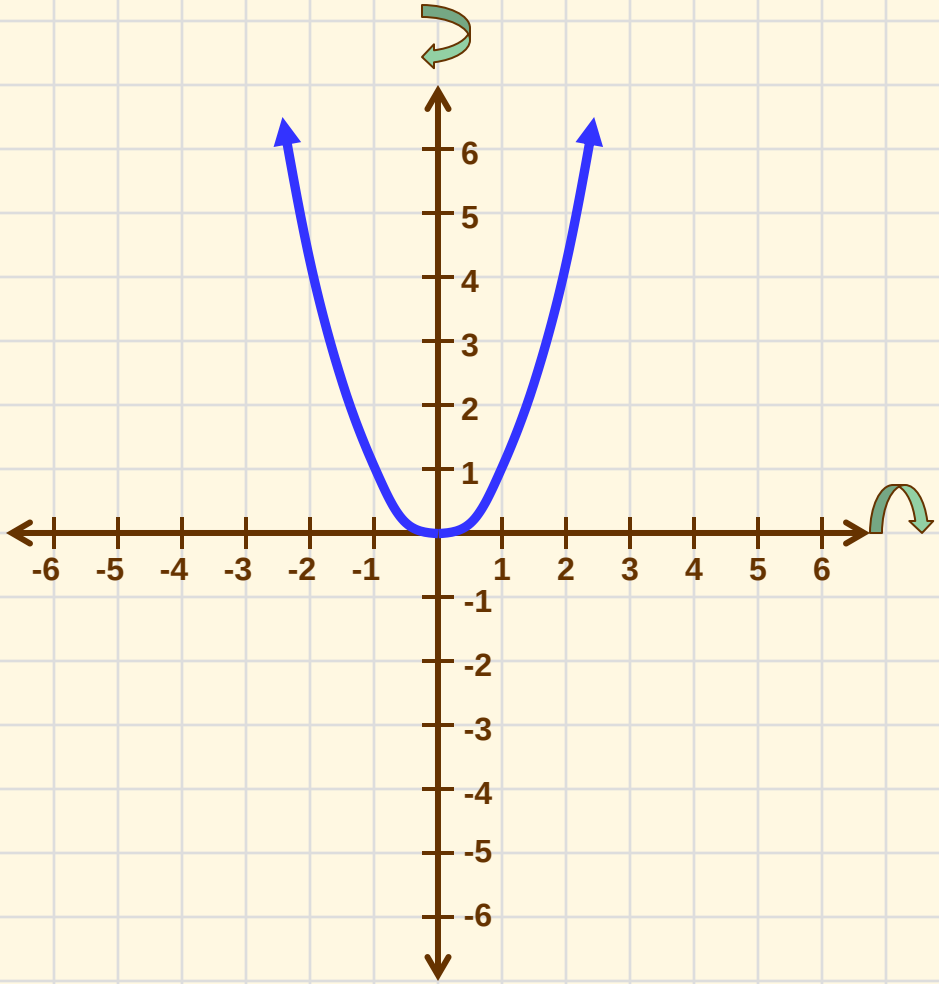
Horizontal Shifts

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



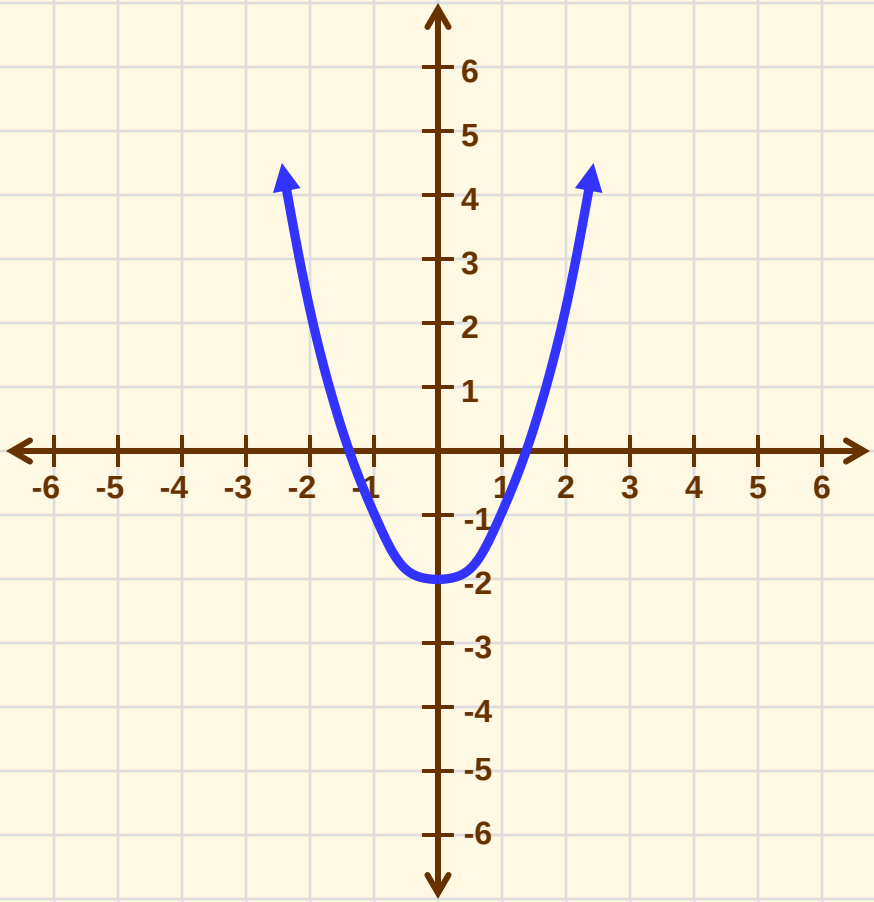
Reflections

- 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

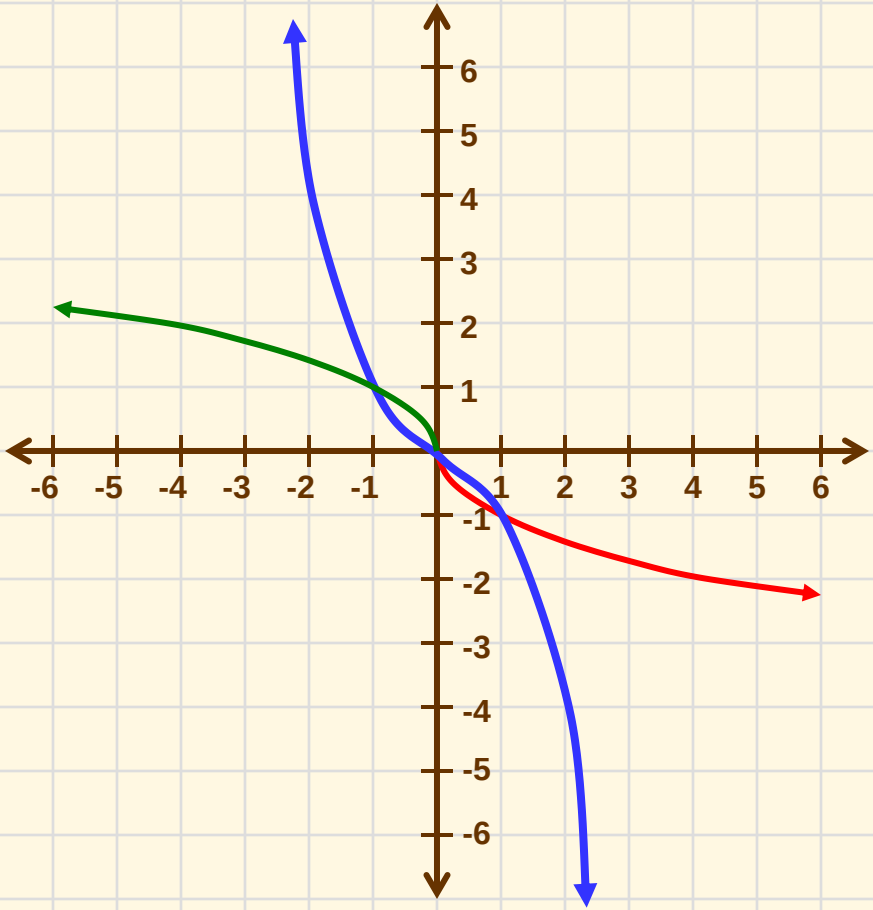
- Stretching / shrinking (graph is the stretched or shrunk vertically / horizontally)
  - The graph of y = cf(x) is the graph of y = f(x) vertically stretched (multiplies y-coordinates by c)
    - Think of grabbing the top and bottom of the graph and stretching it
  - The graph of y = f(cx) is the graph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



Example Graphs

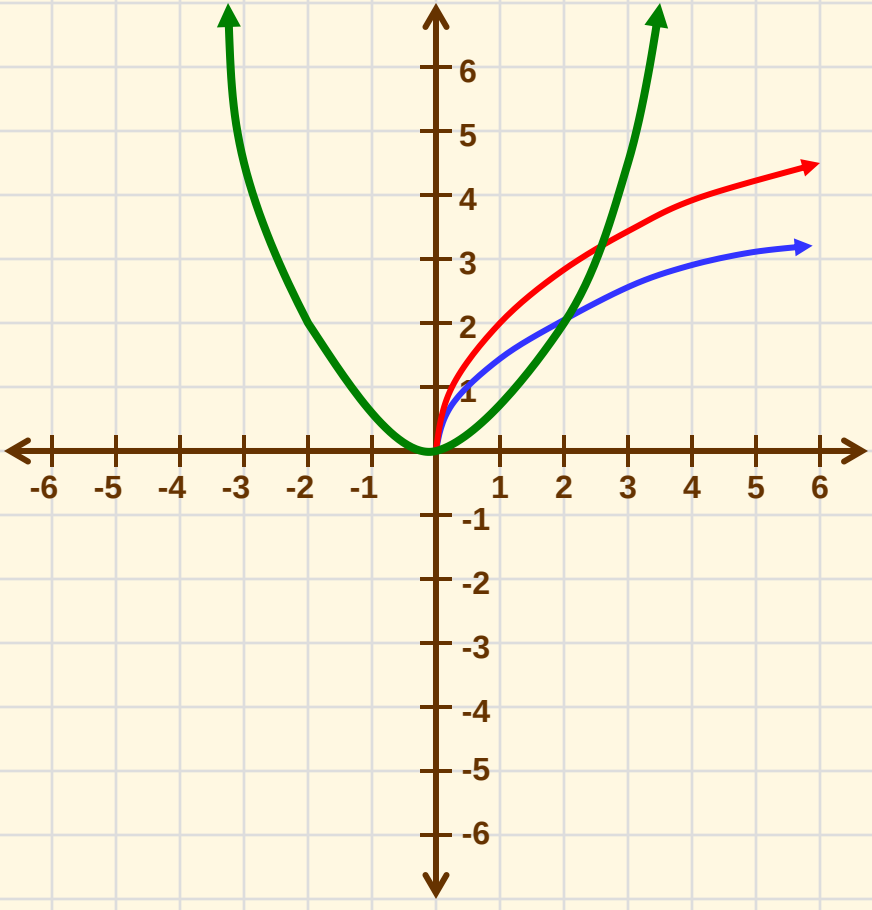
Reflections

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



Stretching / Shrinking

f(x) = 2sqrt(x), g(x) = sqrt(2x), h(x) = ½x^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