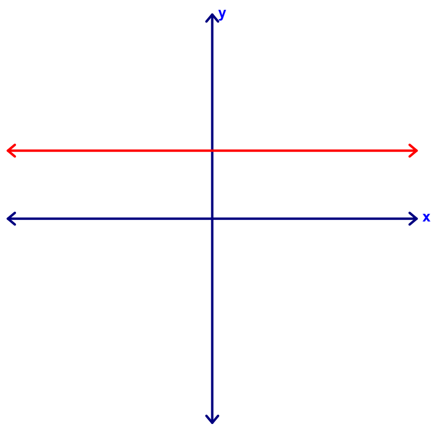
Below are the graphs, names and equations of eight common functions that you will need to know.

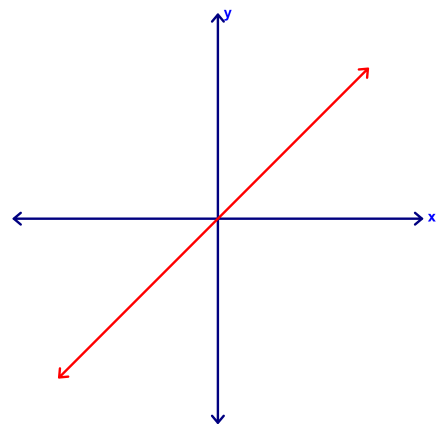
You need to memorize the graphs of these functions along with their corresponding equations and names. You will have a matching homework quiz at the start of the next class – worth 16 points. Hopefully, you already know most of these – good luck!

Common Functions

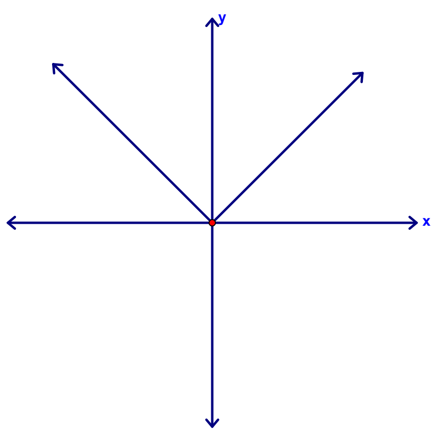
The eight graphs show in the figures below represent the most commonly used functions in algebra. Familiarity with the basic characteristics of these simple graphs will help you analyze the shapes of more complicated graphs – in particular, graphs obtained from these common graphs by the rigid and non-rigid transformations that are studied in the next section.



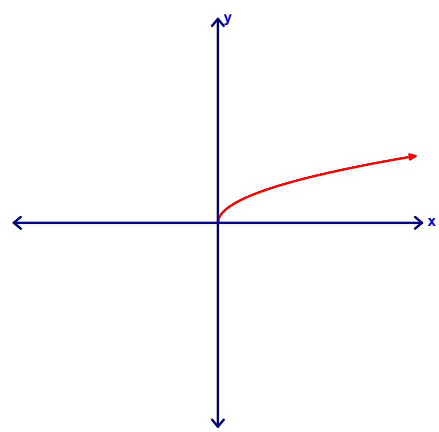
Constant
$f(x) = c$



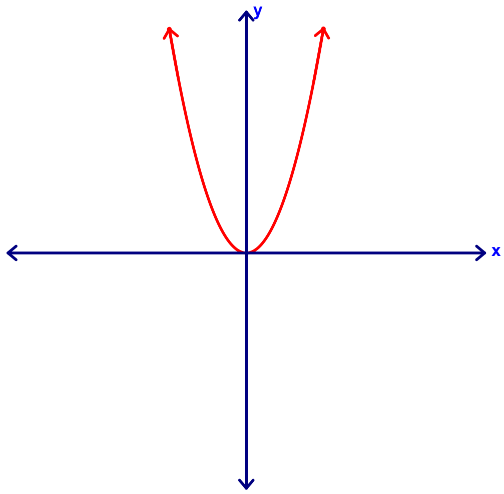
Identity
$f(x) = x$



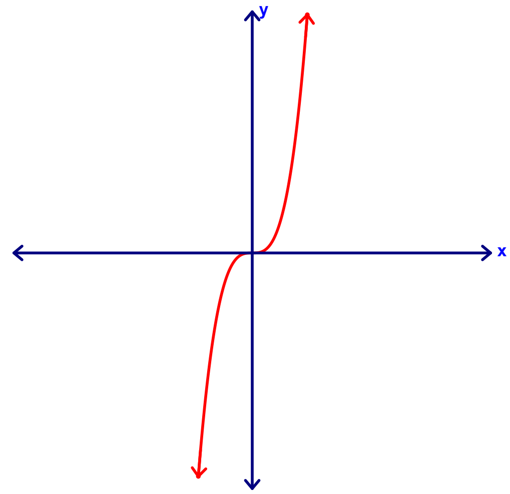
Absolute Value
$f(x) = |x|$



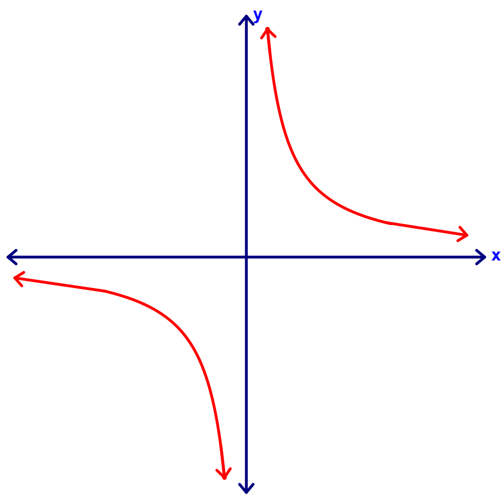
Square Root
$f(x) = \sqrt{x}$



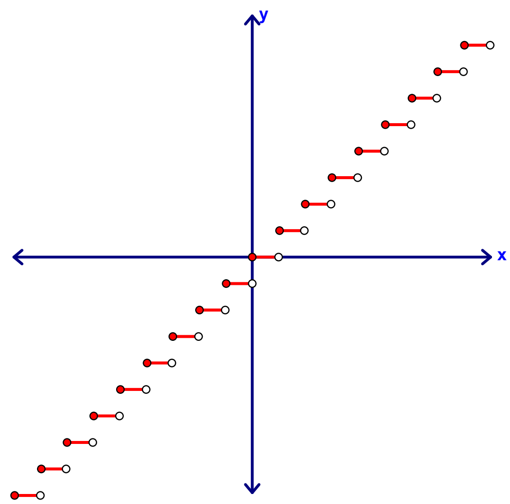
Quadratic
$f(x)=x^2$



Cubic
$f(x)=x^3$



Reciprocal
$f(x)=\frac{1}{x}$



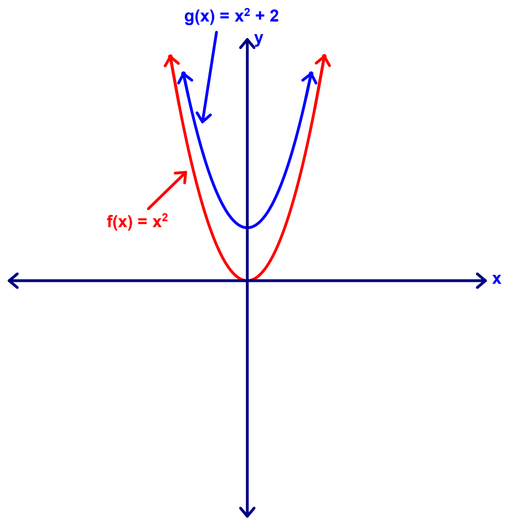
Greatest Integer
$f(x)=[\![x]\!]$

Shifting Graphs

Many functions have graphs that are simple transformations of the parent graphs we talked about in the previous section. For example, you can obtain the graph of

$$h(x)=x^2+2$$

by shifting the graph of $f(x)=x^2$ *upward* two units, as show below:



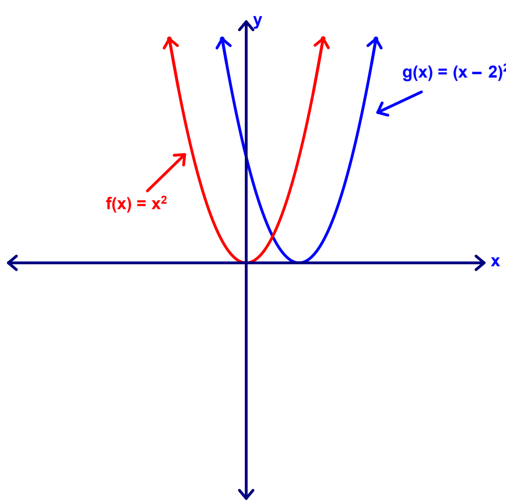
In function notation, *h* and *f* are related as follows:

$$h(x)=f(x)+2=x^2+2$$

Similarly, you can obtain the graph of

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

by shifting the graph of $f(x)=x^2$ *to the right* two units, as shown below:



In this case, the functions *g* and *f* have the following relationship:

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

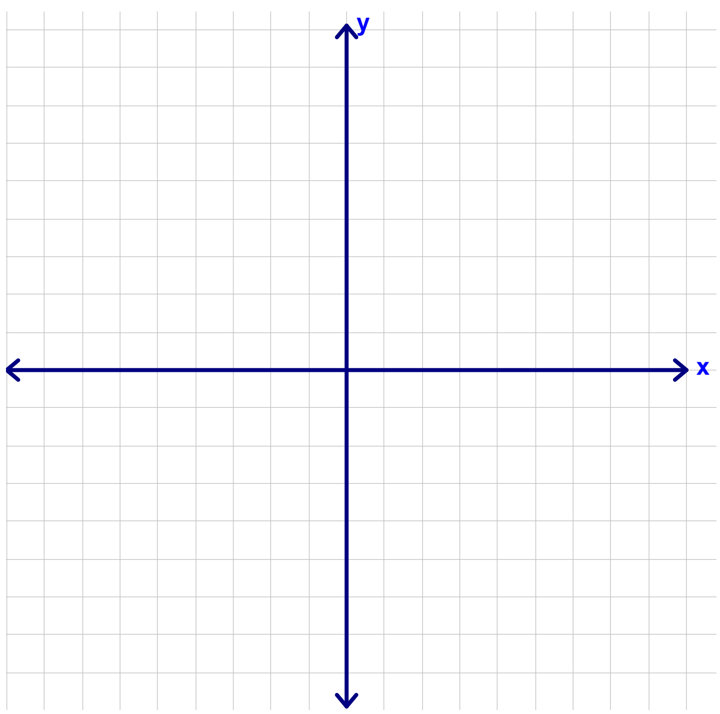
These shifts are called *rigid transformations* and can be summarized as shown below:

Let c be a positive real number. Vertical and horizontal shifts in the graph of $y = f(x)$, are represented as follows:

1. Vertical shift *c* units *upward:* $h(x) = f(x) + c$
2. Vertical shift *c* units *downward:* $h(x) = f(x) - c$
3. Horizontal shift *c* units to the *right:* $h(x) = f(x-c)$
4. Horizontal shift *c* units to the *left:* $h(x) = f(x+c)$

Try this:

Describe in words how the graph $y = (x+2)^2 - 3$ will be transformed from the graph of $f(x) = x^2$, then sketch the new graph



Reflecting Graphs

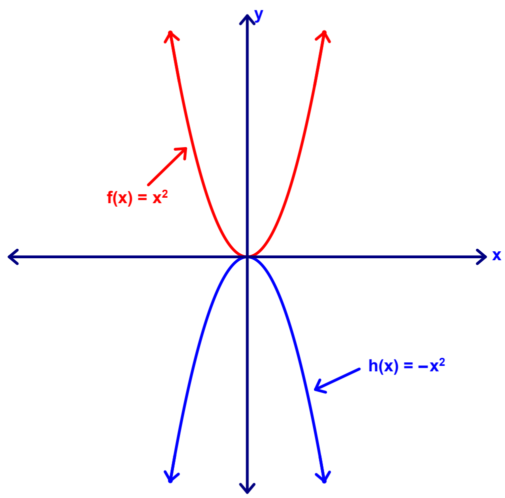
The second common type of transformation is a *reflection*. If you consider the *x*-axis to be a mirror, the graph of

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

is the mirror image (or reflection) of the graph of

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

as shown below:



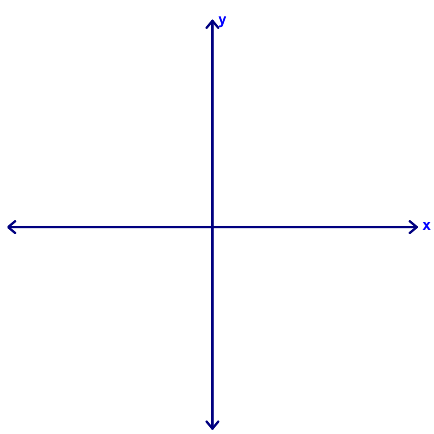
Reflections in the coordinate axes of the graph of $y = f(x)$ are represented as follows:

1. Reflection in the *x*-axis: $h(x) = -f(x)$
2. Reflection in the *y*-axis: $h(x) = f(-x)$

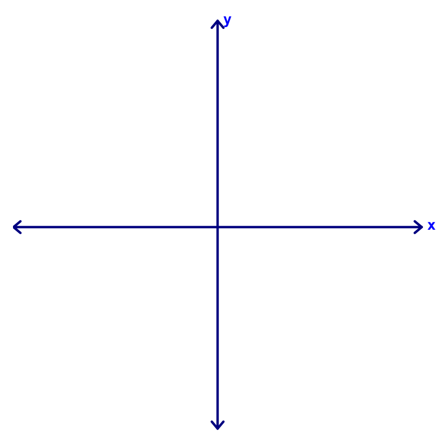
Try this:

Sketch the following two graphs without using your calculator:

$y = -\sqrt{x+2}$



$y = \sqrt{-x+2}$



Nonrigid Transformations

The transformations we just discussed are *rigid* since the basic shape of the graph is unchanged….only the position of the graph is affected. *Nonrigid transformations* are those that cause a distortion or change in the shape of the original graph. We will be considering vertical and horizontal *stretches* and *shrinks*.

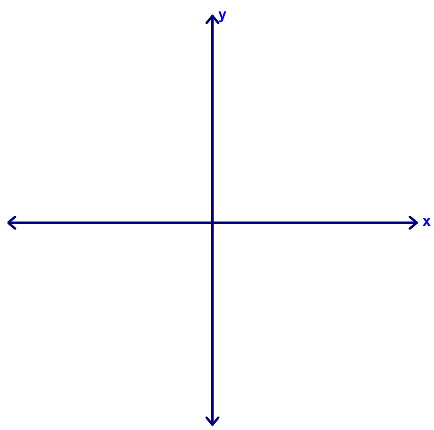
Vertical and Horizontal stretches and shrinking of the graph of $y = f(x)$ are represented as follows:

1. $g(x) = cf(x)$
   vertical stretch if $c > 1$ vertical shrink if $0 < c < 1$

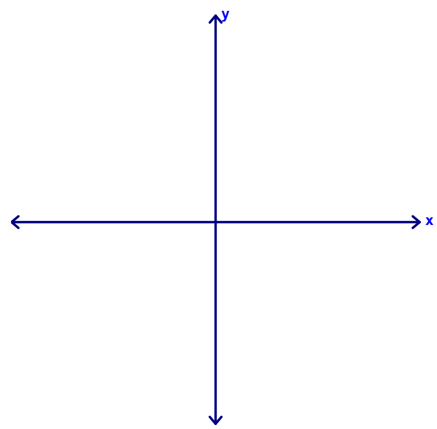
2. $g(x) = f(cx)$
   horizontal stretch if $0 < c < 1$ horizontal shrink if $c > 1$

Try this:
Sketch the following two graphs without using your calculator:

$y = 3|x|$



$y = \frac{1}{3}|x|$



Suggested problems for homework (you don't have to do all of these!):
p.71-73 # 1, 5, 29, 33, 43, 49, 61b, 65, 71
p. 79-80 #1, 9, 10, 19-22 (a-c only)
p. 80-81 #23, 25, 27, 29 (a-c only), 43, 45, 47, 49, 55, 57, 59