Unit 9.1 Notes

A ***translation*** is a transformation that shifts a graph vertically, horizontally, or both without changing its shape or orientation. You can quickly graph absolute value functions by transforming the graph of the ***absolute value parent*** function, $f(x) = |x|$.

Translation (Given that $c > 0,\ d > 0$)

$y = |x| + d$ shifts the function **up** d units

$y = |x| - d$ shifts the function **down** d units

$y = |x - c|$ shifts the function **right** c units

$y = |x + c|$ shifts the function **left** c units

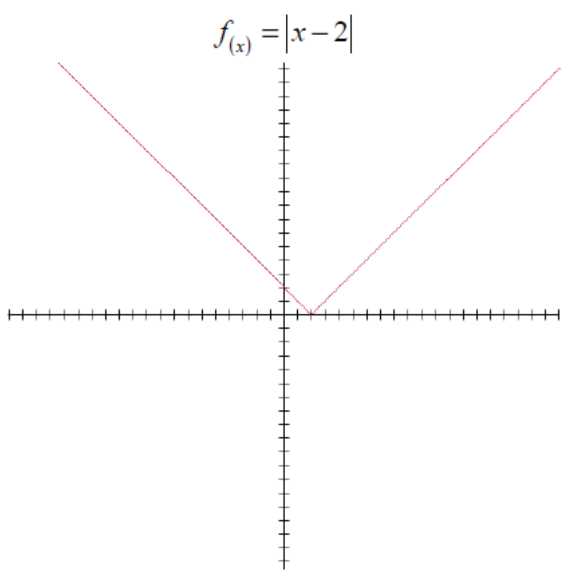
Stretch, Compression, and Reflection are transformations that change the shape or orientation of the graph.

$y = a|x|$ vertical **stretch**, if $|a| > 1$

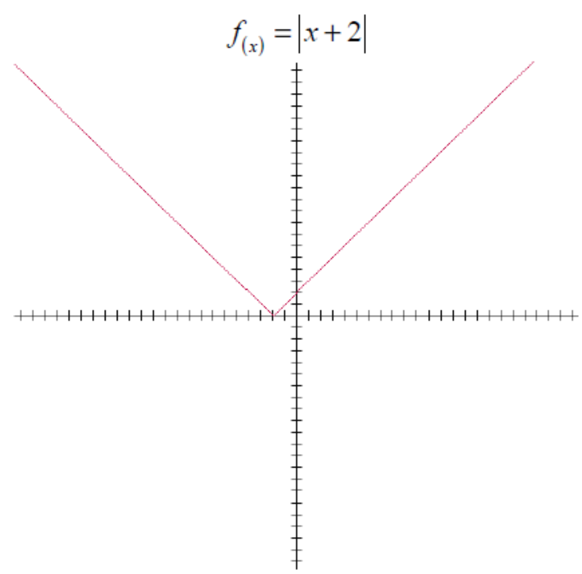
vertical **compression**, if $0 < |a| < 1$

reflection across the $x - axis$, if $a < 0$

Examples:



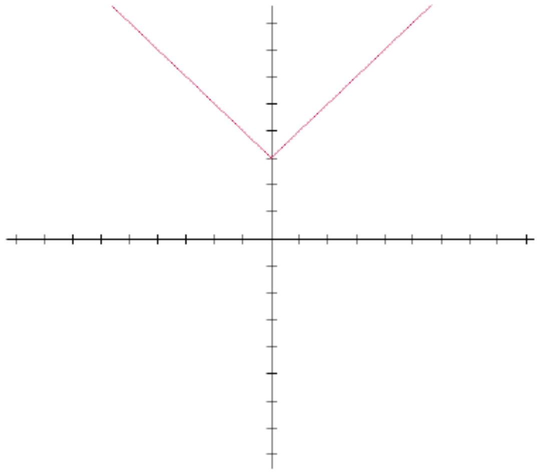
The graph of this function shifts to the right 2.



The graph of this function shifts to the left 2.

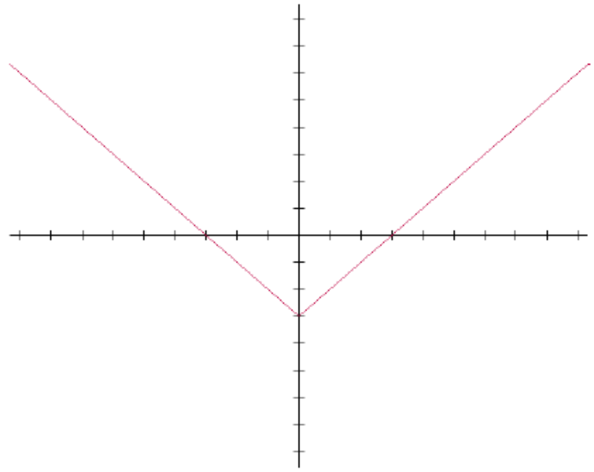
Once again, notice that the value of h determines the horizontal shift of the function. If the function is defined as $f_{(x)}$, the graph on the left is $f_{(x-2)}$, while the graph on the right is $f_{(x+2)}$.

$f_{(x)} = |x| + 3$



The graph of this function shifts up 3.

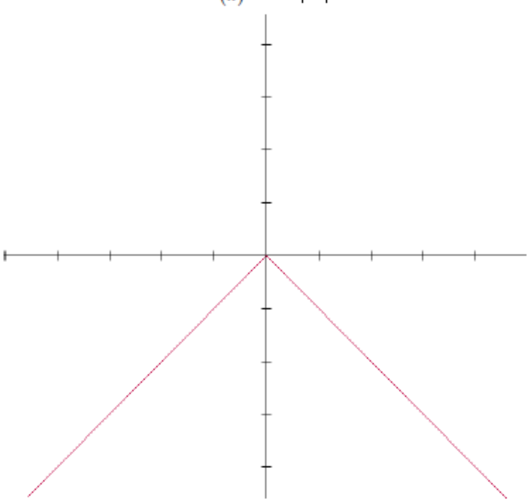
$f_{(x)} = |x| - 3$



The graph of this function shifts down 3.

The value of k, for an absolute value function in standard form determines the vertical shift of the function. As before, if the function is simply defined as $f_{(x)}$, we are looking at $f_{(x)} + 3$ and $f_{(x)} - 3$ respectively.

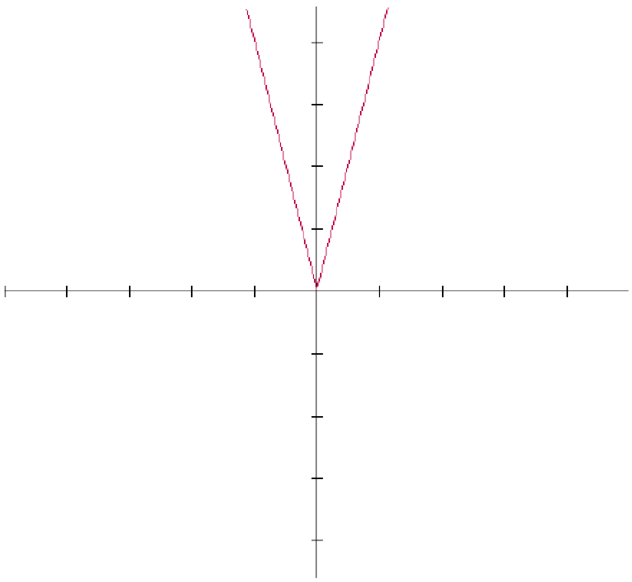
$f_{(x)} = -|x|$



On the left we have the opposite of the parent function. In this example, the value of a, in the standard form is -1. A negative reflects the graph of the function about the horizontal axis. This is read as the opposite of the absolute value of x. If the parent function given is referred to as $f_{(x)}$, this function is $-f_{(x)}$.

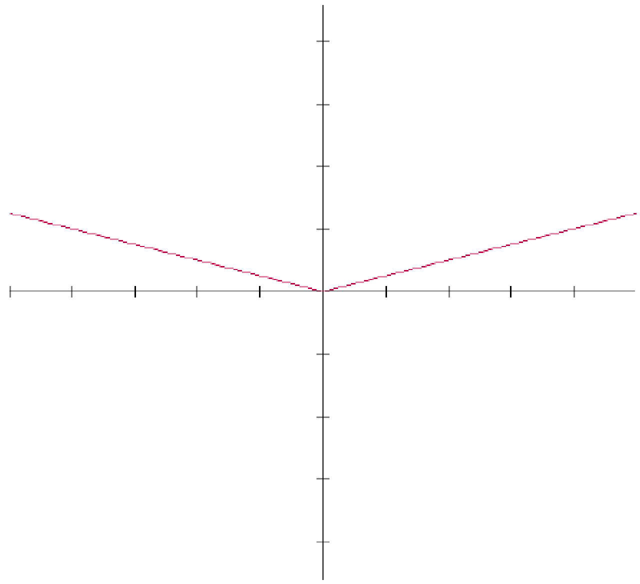
Here we will see how the value of a in an absolute value function in standard form affects the graph of the function. To illustrate this, we will look at the following graphs that have their vertices on the origin.

$$f_{(x)} = 4|x|$$



This graph seems very narrow, but what is actually happening, is the value of the function is increasing very rapidly. The y values are increasing at 4 times their normal rate. The rapid increase causes the graph to appear narrow.

$$f_{(x)} = \frac{1}{4}|x|$$



This graph is wider than the parent function. In this case, the y values of the function are increasing at ¼ their normal rate, causing a more gradual increase.

If the value of the leading coefficient is a whole number, the y values of the graph will increase rapidly causing a narrow graph and more extreme slope. If the leading coefficient is a fraction, the y values of the function will increase mildly, yielding a more gradual slope.