

3.7 Graphing Absolute Value Functions

Essential Question: How do the values of a , h , and k affect the graph of the absolute value function?

Learning Targets:

- I can translate graphs of absolute value functions.
- I can stretch shrink and reflect graphs of absolute value functions.
- I can combine transformations of graphs of absolute value functions.

Absolute Value Function

An absolute value function

is a function that contains an absolute value expression.

The parent absolute value function is $f(x) = |x|$.

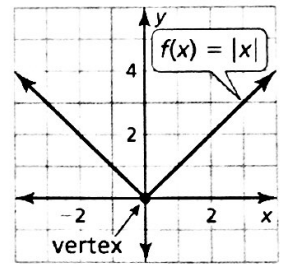
The graph of $f(x) = |x|$ is V-shaped and symmetric about the y -axis.

The vertex is the point where the graph changes direction.

The vertex of the graph $f(x) = |x|$ is $(0, 0)$.

The domain of $f(x) = |x|$ is all real numbers.

The range is $y \geq 0$ for the parent function.



Vertex Form of an Absolute Value Function

An absolute value function written in the form $g(x) = a|x - h| + k$, where $a \neq 0$, is in **vertex form**.

The vertex of the graph of g is (h, k) .

What does k do to the graph? moves the graph up (if $k > 0$) or down (if $k < 0$), same as for linear functions

What does a do to the graph? vertically stretches the graph if $a > 1$, vertically shrinks the graph if a is between 0 and 1 ($0 < a < 1$) same as for lines

New transformation:

What does h do to the graph? moves the graph horizontally. If the expression is $|x + h|$ the graph will move left h units. If the expression is $|x - h|$ the graph will move right h units

Any absolute value function can be written in vertex form, and its graph is symmetric about the line $x = h$ (vertical line)

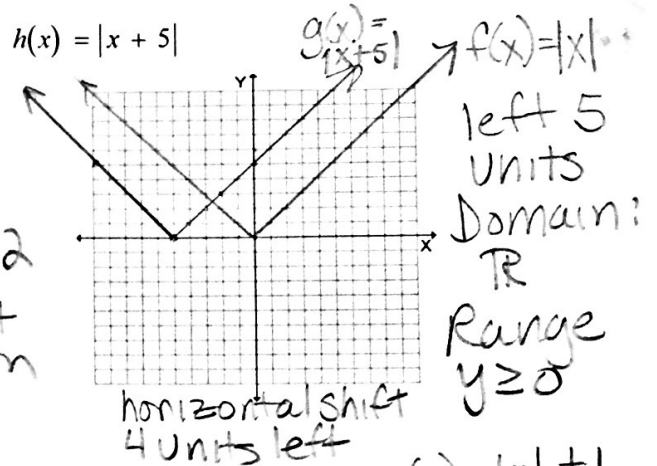
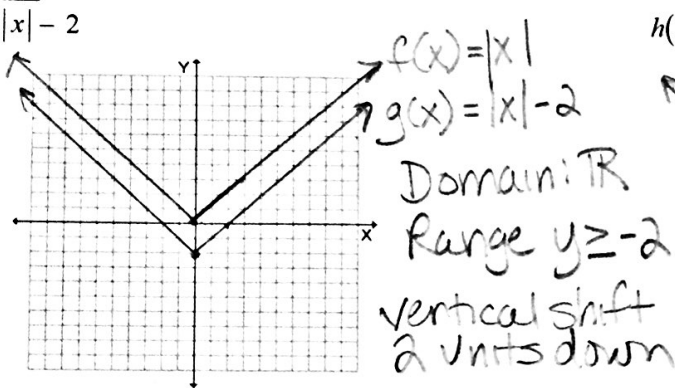
3.7 Graphing Absolute Value Functions

Translating the graphs of absolute value functions:

Graphing $g(x) = |x| + k$ and $g(x) = |x - h|$: Graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

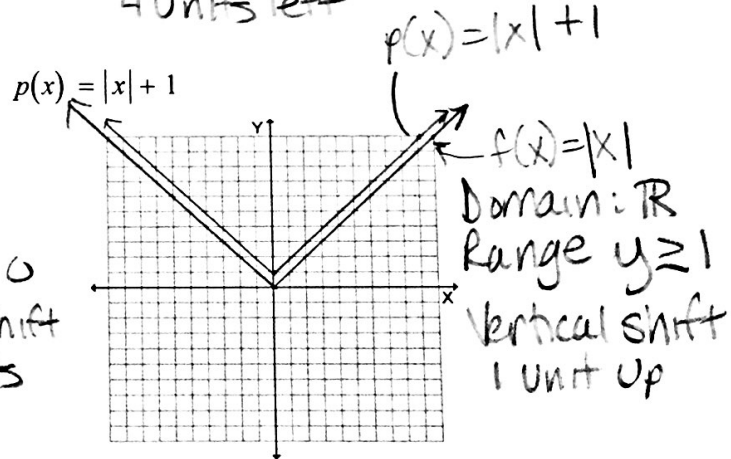
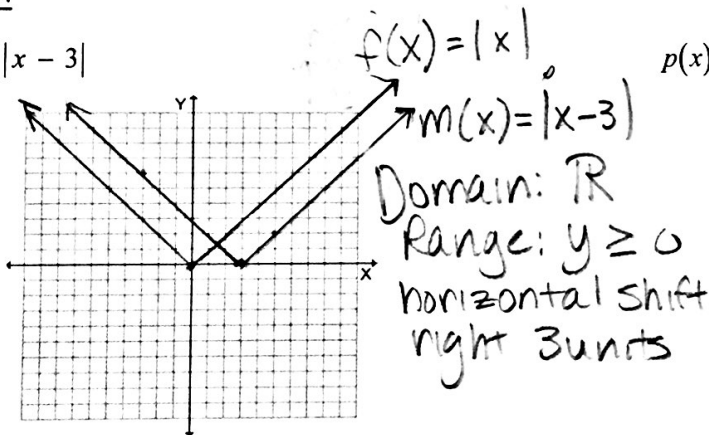
Examples:

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



You try:

$m(x) = |x - 3|$



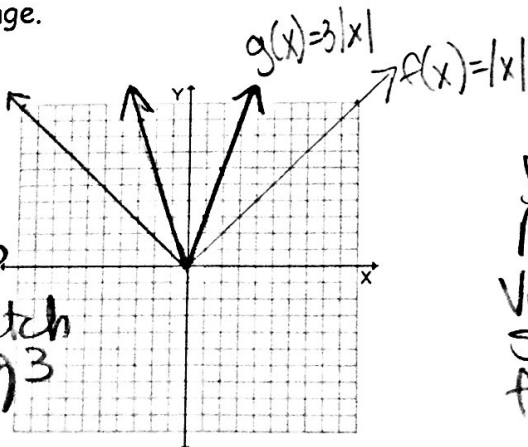
Stretching and Shrinking Absolute Value Functions:

Graphing $(x) = a|x|$: Graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

Example:

$g(x) = 3|x|$

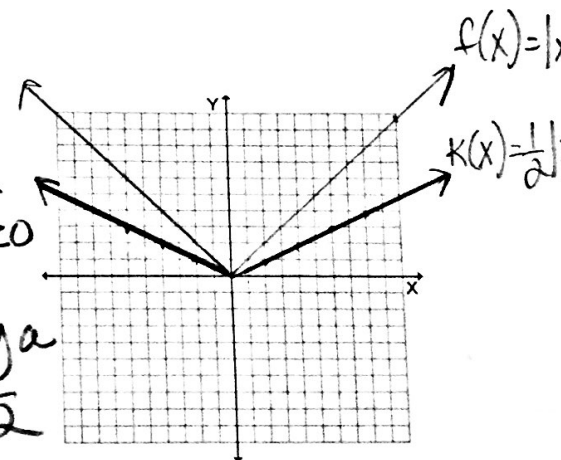
Domain: \mathbb{R}
 Range: $y \geq 0$
 vertical stretch by a factor of 3



You try:

$k(x) = \frac{1}{2}|x|$

Domain: \mathbb{R}
 Range: $y \geq 0$
 vertical shrink by a factor of $\frac{1}{2}$



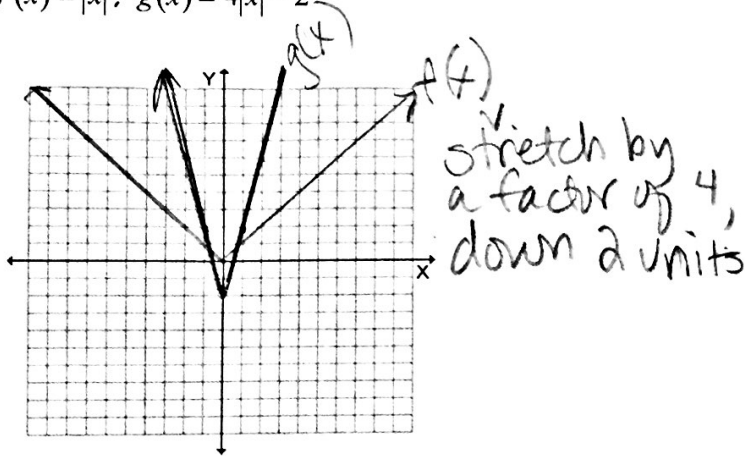
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Combining Transformations:

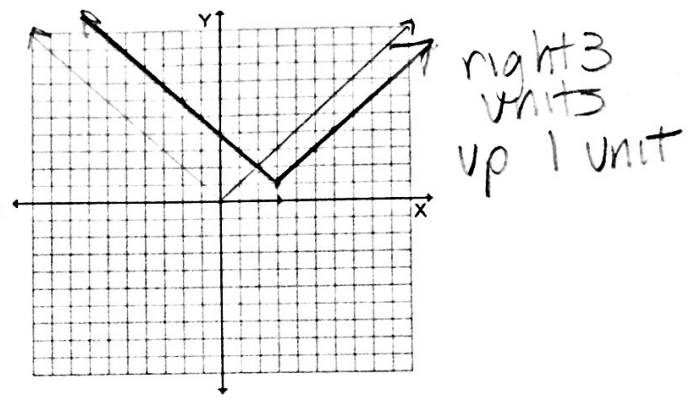
Graphing $(x) = |x - h| + k$. Graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

Examples:

$$f(x) = |x|; g(x) = 4|x| - 2$$

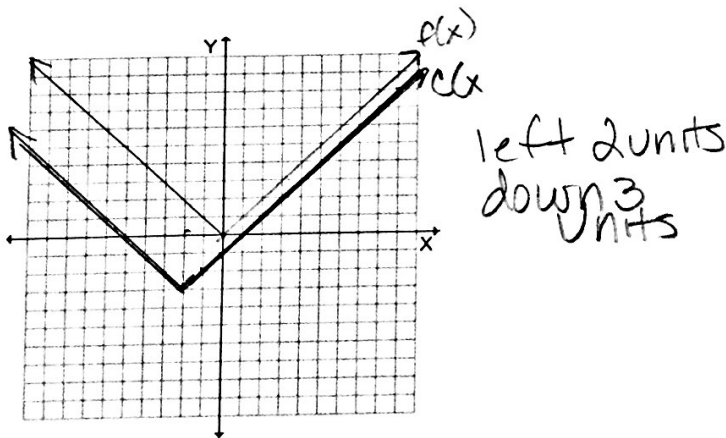


$$f(x) = |x|; m(x) = |x - 3| + 1$$

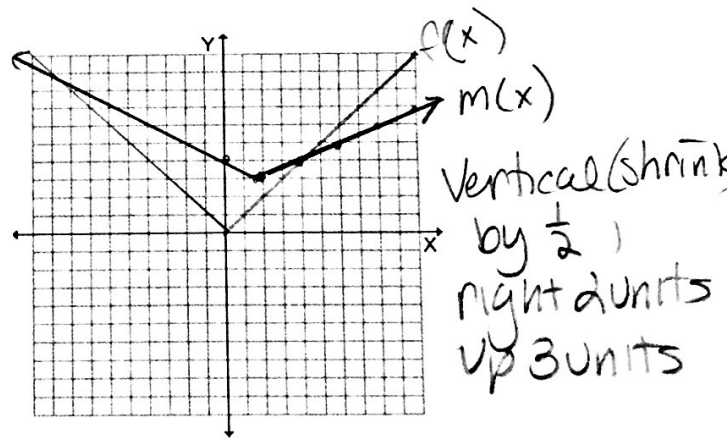


You try:

$$f(x) = |x|; c(x) = |x + 2| - 3$$



$$f(x) = |x|; m(x) = \frac{1}{2}|x - 2| + 3$$



Closure: What I learned today was...