Algebra 2

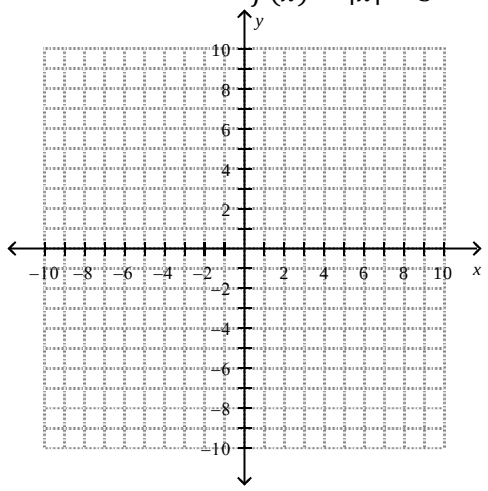
Lesson 2-5: Absolute Value Functions and Graphs

Mrs. Snow, Instructor

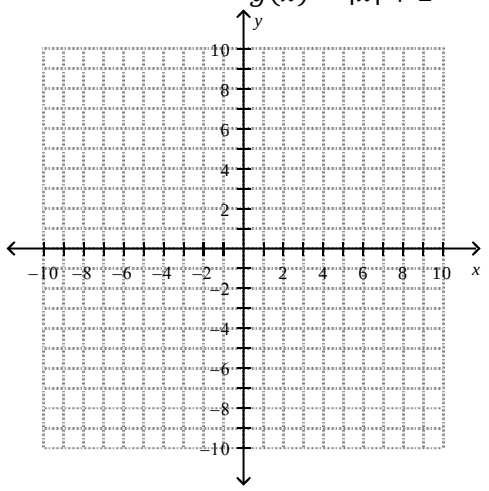
An **absolute value function** is a function that contains an absolute value expression: $\boldsymbol{f(x) = |mx + b| + c}$. The parent function has equation in the form of $y = |x|$.

An absolute value function graph is characterized by a **v-shape.** Like all other parent functions, absolute value functions can transformations that move left, right, up, down, compress, stretch, or a combination. When absolute value functions move up or down (translate), they will have the form of $\boldsymbol{f(x) = |x| + c}$

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



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

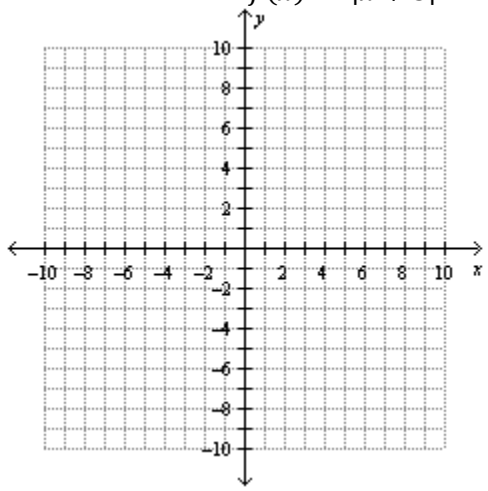


Absolute value functions that move left or right have the form: $\boldsymbol{f(x) = |mx + b| + c.}$
The related equation is: $\mathbf{y} = \boldsymbol{|mx + b| + c}$

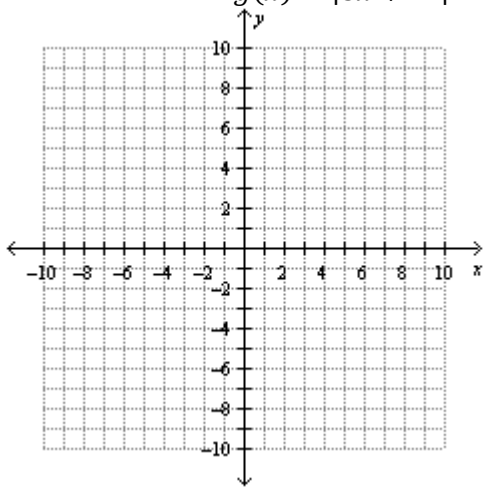
The **vertex** of a function is a point where the function reaches a maximum or a minimum.

The vertex of $y = |\boldsymbol{mx + b}| + \boldsymbol{c}$ **is located at the point** $(-\frac{\boldsymbol{b}}{\boldsymbol{m}}, \boldsymbol{c})$

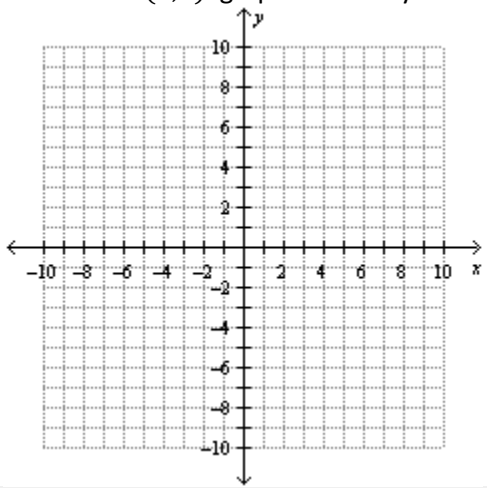
$f(x) = |x + 3|$



$g(x) = |3x + 12|$



Important: the vertex may also be found by understanding that the vertex occurs when the contents inside the absolute value equals 0. So for example:

$g(x) = \|x - 4\| + 2$: $x - 4 = 0,$ $x = 4$ $y = \|4 - 4\| + 2$ $y = 2$ Vertex is at $(4,2)$ graph and verify! 	1. set the contents of the absolute value equal to zero. 2. Solve for s 3. Here at $x = 4$ the absolute value goes to zero 4. Now plug in $x = 4$ into the original equation and solve for y

Graphing Calculator: (while really cool, you are expected to generate an absolute value graph by hand, no calculator!!)

1. Graphing an absolute value function can be accomplished using the tried and true method by selecting x or y values and solving the equation for the remaining variable and graph the x-y coordinates.

2. Absolute value functions can also be graphed on a graphing calculator:

1) Y=
2) MATH → NUM <enter>
3) type equation
4) ZOOM 5 you graph should appear!

Two Linear Equation Method: An absolute value function may also be graphed by writing the equation as 2 linear equations with the domain restricted. You are expected to understand and know this method!:

1. isolate the absolute value (get it by itself) on the right side of the equal sign
2. using the definition of absolute value write 2 equations:
   CASE1 – "as is" and CASE 2 – bring down and take the negative of the absolute value.
3. solve for y
4. graph each equation for the appropriate domain

(remember the domain comes from the definition)

The key is to understand that the "stuff" inside the abs. val. may be negative or positive, such as:
$|5| = 5\ and\ |-5| = 5.$

So, for our example $x - 3 = +\#\ and\ x - 3 = -\#$,
$hence\ the\ \geq 0\ and\ \leq 0$ for the domains.

Solve: $y = |x - 3| + 5$

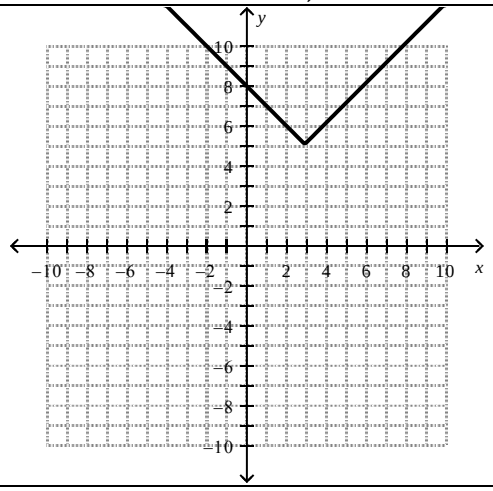
$y - 5 = |x - 3|$

*when $x - 3 \geq 0$	when $x - 3 \leq 0$
$\therefore\ x \geq 3$	$\therefore\ x \leq 3$
CASE 1	**CASE 2**
"as-is"	negative of abs. val.
$y - 5 = x - 3$	$y - 5 = -(x - 3)$
$y = x + 2$	$y - 5 = -x + 3$
	$y = -x + 8$

*domains: $x \geq 3$ $x \leq 3$

domains are found by solving each equation for x

$x - 3 \geq 0, and\ x - 3 \leq 0$



You will need to be comfortable using each of the above described methods.