Warm-Up (11/7/17)

Graph the following piecewise function:

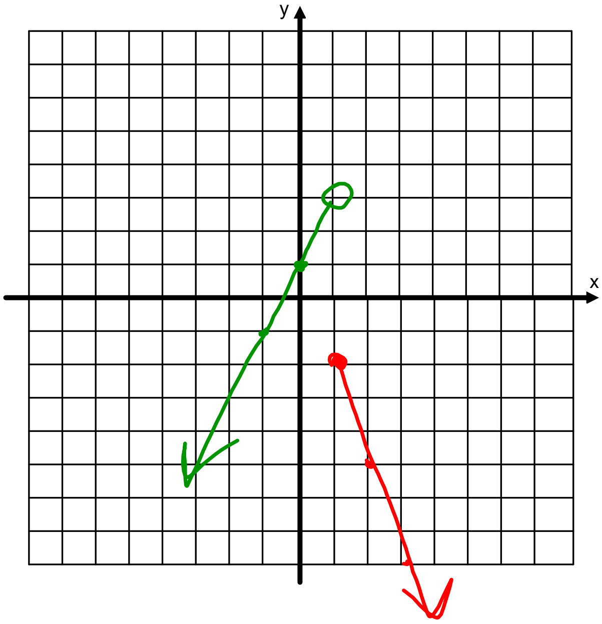
$$f(x) = \begin{cases} -3x + 1 & x \geq 1 \\ 2x + 1 & x < 1 \end{cases}$$

$f(x) = -3x + 1$

x	f(x)
1	-2
2	-5
3	-8

$f(x) = 2x + 1$

x	f(x)
1	3
0	1
-1	-1



Absolute Value

- Students will be able to evaluate and graph the absolute value function.
- Students will be able to identify the key characteristics of an absolute value graph.

What is an "Absolute Value" function?

An absolute value function is a special piecewise function defined by the following:

$$f(x) = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$

Use for x values greater than 0

$f(x) = x$

x	f(x)
0	0
1	1
2	2
3	3
4	4

Use for x values less than 0

$f(x) = -x$

x	f(x)
0	0
-1	1
-2	2
-3	3
-4	4

What pattern do we observe about the inputs and outputs of an absolute value function?

We observe that every input, whether it is positive or negative, will result in a positive output.

Absolute value notation

The piecewise function $f(x) = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$ can be shortened and read as the following:

$$f(x) = |x|$$

This is read as "f of x is equal to the absolute value of x" and it is a condensed version of the piecewise definition from before.

Evaluating Absolute Value Functions

A general rule for absolute value functions is that whatever the resulting inner number is, whether it's positive or negative, will result will be positive. (But, just because we have an absolute value function doesn't mean that out output for the function will always be positive).

For example: $f(x)=|x|$

$f(2)=|2|=2$ $f(-2)=|-2|=2$

When we evaluate absolute value, we evaluate everything inside the absolute value first. The "bars" act like parenthesis, with the exception that we are not able to distribute from the outside to the inside.

Example:

Complete the following table for the absolute value function $f(x) = |2x - 2|$.

x (Input)	Calculation	f(x) (Output)
-3	$f(-3) = \|2(-3) - 2\| = \|-6 - 2\| = \|-8\| = 8$	8
-2	$f(-2) = \|2(-2) - 2\| = \|-4 - 2\| = \|-6\| = 6$	6
-1	$f(-1) = \|2(-1) - 2\| = \|-2 - 2\| = \|-4\| = 4$	4
0	$f(0) = \|2(0) - 2\| = \|0 - 2\| = \|-2\| = 2$	2
1	$f(1) = \|2(1) - 2\| = \|2 - 2\| = \|0\| = 0$	0
2	$f(2) = \|2(2) - 2\| = \|4 - 2\| = \|2\| = 2$	2
3	$f(3) = \|2(3) - 2\| = \|6 - 2\| = \|4\| = 4$	4

Example:

Complete the following table for the absolute value function $f(x) = |2x| - 2$.

x (Input)	Calculation	f(x) (Output)
-3	$f(-3) = \|2(-3)\| - 2 = \|-6\| - 2 = 6 - 2 = 4$	4
-2	$f(-2) = \|2(-2)\| - 2 = \|-4\| - 2 = 4 - 2 = 2$	2
-1	$f(-1) = \|2(-1)\| - 2 = \|-2\| - 2 = 2 - 2 = 0$	0
0	$f(0) = \|2(0)\| - 2 = \|0\| - 2 = 0 - 2 = -2$	-2
1	$f(1) = \|2(1)\| - 2 = \|2\| - 2 = 2 - 2 = 0$	0
2	$f(2) = \|2(2)\| - 2 = \|4\| - 2 = 4 - 2 = 2$	2
3	$f(3) = \|2(3)\| - 2 = \|6\| - 2 = 6 - 2 = 4$	4

Example:

Complete the following table for the function

$$f(x) = -|x| + 1$$

x (Input)	Calculation	f(x) (Output)
-3	$f(-3) = -\|(-3)\| + 1 = -\|-3\| + 1 = -(3) + 1 = -3 + 1 = -2$	-2
-2	$f(-2) = -\|-2\| + 1 = -2 + 1$	-1
-1	$f(-1) = -\|-1\| + 1 = -1 + 1$	0
0	$f(0) = -\|0\| + 1 = -0 + 1$	1
1	$f(1) = -\|1\| + 1 = -1 + 1$	0
2	$f(2) = -\|2\| + 1 = -2 + 1$	-1
3	$f(3) = -\|(3)\| + 1 = -\|3\| + 1 = -(3) + 1 = -3 + 1 = -2$	-2

Graphing Absolute Value Functions

As with any newly-introduced equation, the best way to start graphing absolute value functions is to set up a table of values.

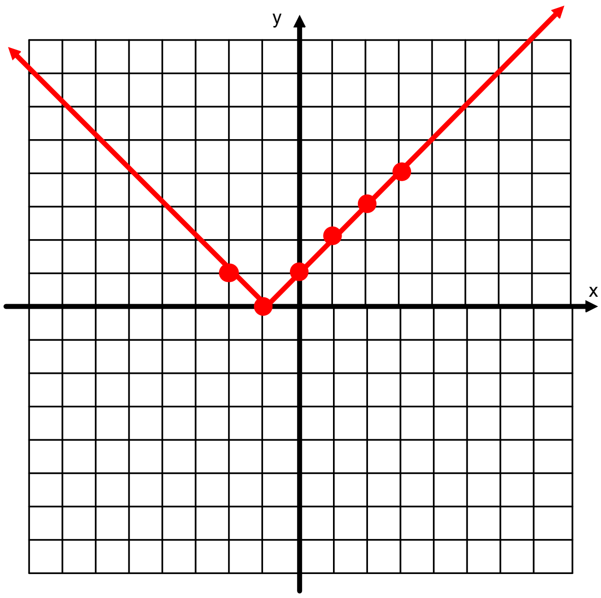
After setting up a good table of values then we can connect our ordered pairs to see what the final product looks like.

Example:

Graph the following absolute value function:

$$f(x) = |x + 1|$$

x	f(x)
-2	1
-1	0
0	1
1	2
2	3
3	4



$$f(-2) = |(-2) + 1| = |-2 + 1| = |-1| = 1$$

$$f(-1) = |(-1) + 1| = |-1 + 1| = |0| = 0$$

$$f(0) = |(0) + 1| = |0 + 1| = |1| = 1$$

$$f(1) = |(1) + 1| = |1 + 1| = |2| = 2$$

$$f(2) = |(2) + 1| = |2 + 1| = |3| = 3$$

$$f(3) = |(3) + 1| = |3 + 1| = |4| = 4$$

Example:

Graph the following absolute value function:

$$f(x) = -|x| + 1$$

The calculations for the table below is shown on slide 8.

x	f(x)
-3	-2
-2	-1
-1	0
0	1
1	0
2	-1
3	-2