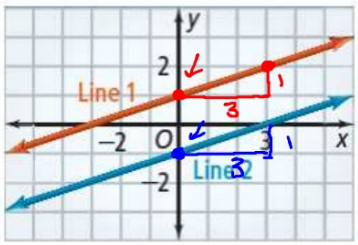
Name _____

5-8 Graphing Absolute Value Functions

OBJECTIVE: I can graph an absolute value function to translate the graph of an absolute value function

Warm-Up



Write the equations of Line 1 and Line 2. How can you transform the equation of Line 1 into the equation of Line 2? How can you slide Line 1 in the coordinate plane so that it becomes Line 2? Explain.

Find the equation to both graphs

Line 1

slope = $\frac{1}{3}$

y-int = 1

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

← $y = mx + b$ →

Line 2

slope = $\frac{1}{3}$

y-int = −1

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

- You can transform line 1 into line 2 by changing y-int into −1
- You can slide line 1 2 units down to become Line 2

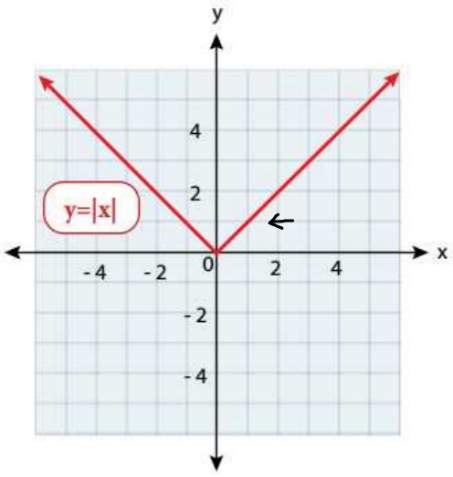
Essential Understanding

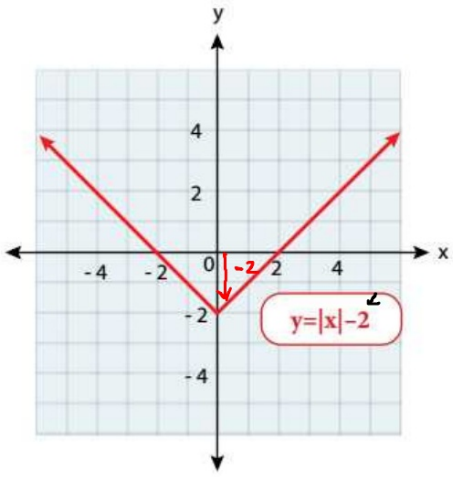
Essential Understanding You can quickly graph absolute value equations by shifting the graph of $y = |x|$.

Parent function

Example #1 Describing Translations

Below are the graphs of $y = |x|$ and $y = |x| - 2$. How are the graphs related?

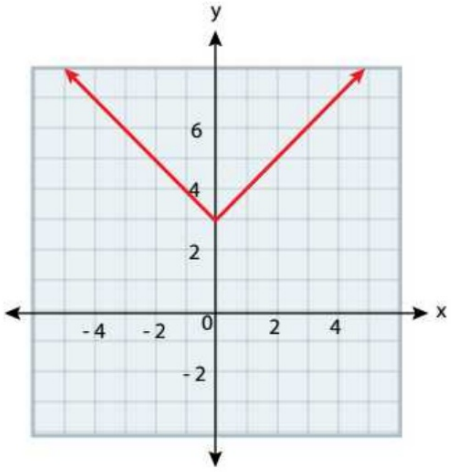




- the graphs have the same shape
- Notice each point on $y=|x|-2$ is 2 units lower than $y=|x|$
- the graph of $y=|x|-2$ was translated 2 units down from $y=|x|$.

Your Turn to Work it Out

1. How is the graph at the right related to the graph of $y = |x|$?



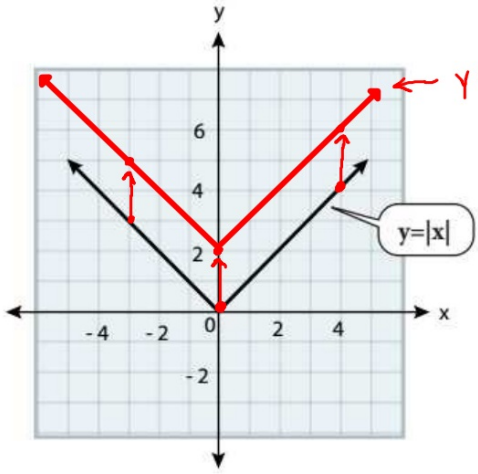
- the graph has the same shape
- the graph is place higher than $y=|x|$
- this graph was translated 3 units up.
- this graph is $y=|x|+3$

Example #2 Graphing a Vertical Translation

What is the graph of $y = |x| + 2$?

Translate 2 units up (Every point)

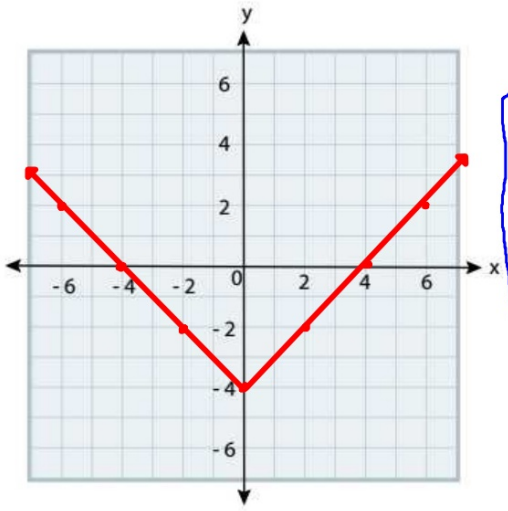
Translating means shifting the graph, not changing it shape or size



Your Turn to Work it Out

2. What is the graph of $y = |x| - 4$?

The graph of $y = |x| - 4$ was translated 4 units down from $y = |x|$.

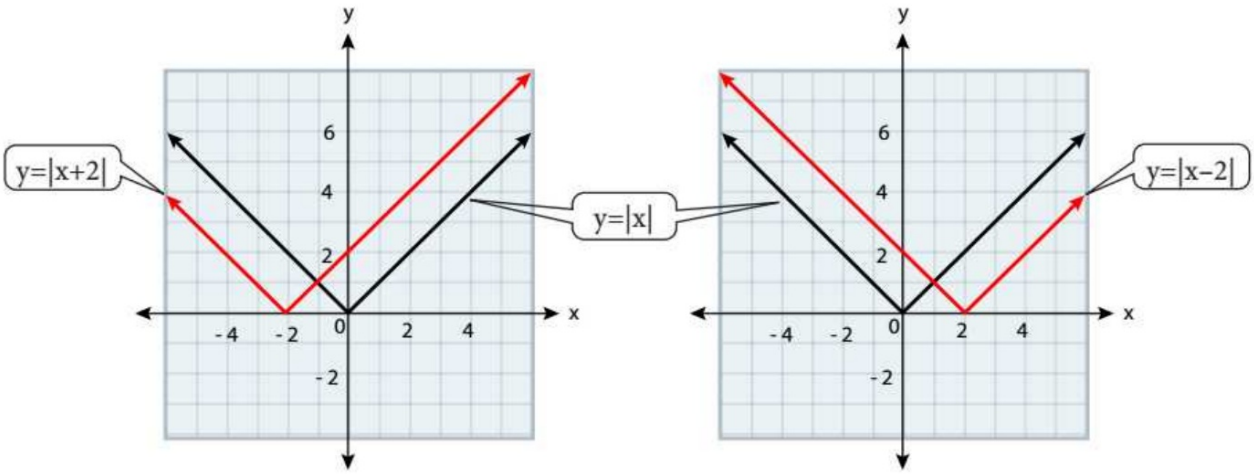


Table

x	$\lvert x\rvert - 4$
-6	$\lvert -6\rvert - 4 = 6 - 4 = 2$
-4	$\lvert -4\rvert - 4 = 4 - 4 = 0$
-2	$\lvert -2\rvert - 4 = 2 - 4 = -2$
0	$\lvert 0\rvert - 4 = 0 - 4 = -4$
2	$\lvert 2\rvert - 4 = 2 - 4 = -2$
4	$\lvert 4\rvert - 4 = 4 - 4 = 0$
6	$\lvert 6\rvert - 4 = 6 - 4 = 2$

Concept Understanding

The graphs below show what happens when you graph $y = |x + 2|$ and $y = |x - 2|$.



For a positive number h, $y = |x + h|$ translates the graph of $y = |x|$ left h units, and $y = |x - h|$ translates the graph of $y = |x|$ right h units.

$y = |x + h| + v$

horizontal (do the opposite)

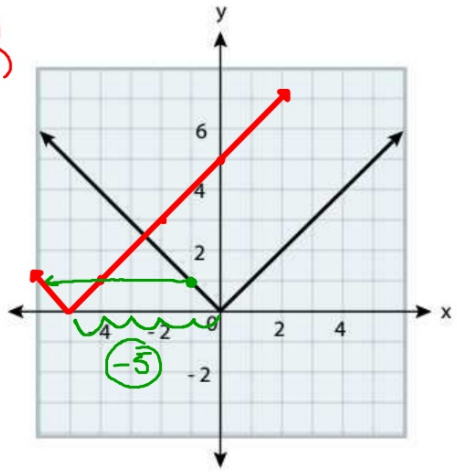
Vertical (do exact)

Example #3 Graphing a Horizontal Translation

What is the graph of $y = |x + 5|$?

+5 move 5 units to the left

horizontal (opposite)



Table

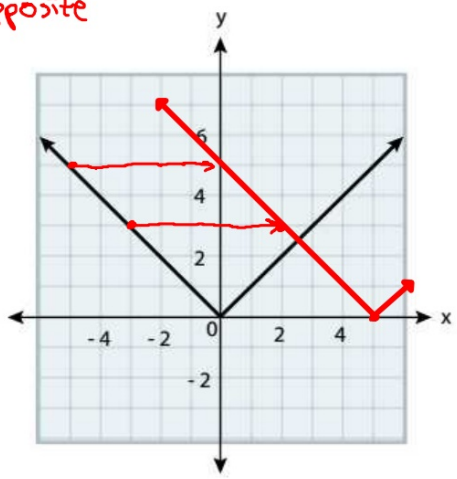
x	$\lvert x+5 \rvert$
-4	$\lvert -4+5 \rvert = 1$
-2	$\lvert -2+5 \rvert = 3$
0	$\lvert 0+5 \rvert = 5$
2	watch the graph
4	

Your Turn to Work it Out

3. What is the graph of $y = |x - 5|$?

opposite

-5 moves 5 units to the right

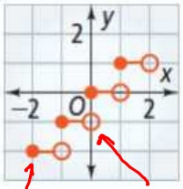


Concept Understanding

The absolute value function is an example of a piecewise function. A piecewise function is a function that has different rules for different parts of its domain. For example, when $x \geq 0$, $|x| = x$. When $x < 0$, $|x| = -x$.

Another example of a piecewise function is a step function. A step function is a function that pairs every number in an interval with a single value.

The graph of a step function can look like the steps of a staircase. Each piece of the graph is a horizontal s segment that is missing its right endpoint, indicated by an open circle.



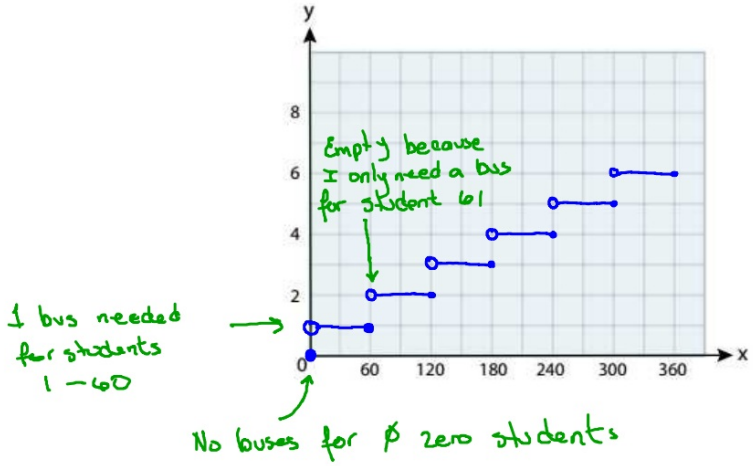
← step function

included

Excluded

Example #4 Graphing a Step Function

Transportation A school will charter buses so that the student body can attend a football game. Each bus holds a maximum of 60 students. Make a graph that models the relationship between the number of students x that go to the game by bus and the number of buses y that are needed.



Your Turn to Work it Out

4. Make a graph that models the relationship between the number of students x that go to the game by bus and the number of buses y that are needed if each bus holds a maximum of 50 students.