

### Lesson 2.7 Warm Up (Marker Boards)

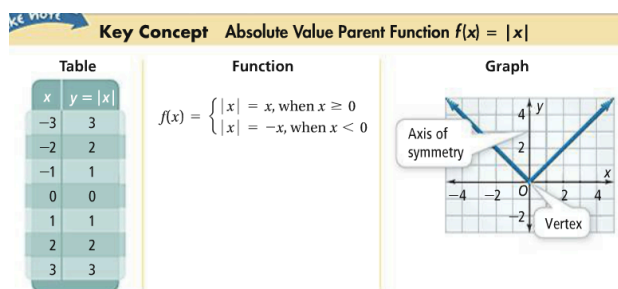
1. What is the new function of  $f(x) = 9x - 5$  after a reflection across the y-axis and then a translation up 2 units?

2. Write the equation in slope-intercept form of a line that goes through  $(-1, 9)$  with a slope of 2.

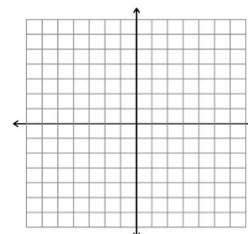
### Lesson 2.7 Absolute Value Functions & Graphs

**Essential Understanding:** Just as the absolute value of  $x$  is its distance from 0, the absolute value of  $f(x)$ , or  $|f(x)|$ , gives the distance from the line  $y = 0$  for each value of  $f(x)$ .

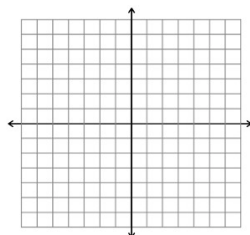
The simplest example of an **absolute value function** is  $f(x) = |x|$ . The graph of the absolute value of a linear function in two variables is V-shaped and symmetric about a vertical line called the **axis of symmetry**. Such a graph has either a single maximum point or a single minimum point, called the **vertex**.



Ex. What is the graph of  $f(x) = |x| - 4$ ? How is this graph different from the graph of the parent function  $f(x) = |x|$ ?

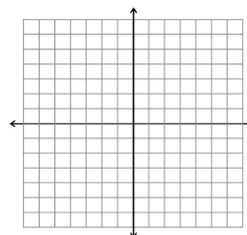


Ex. What is the graph of the function  $y = |x| + 2$ ?



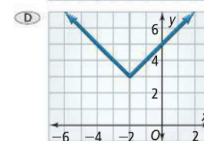
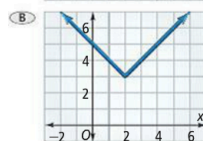
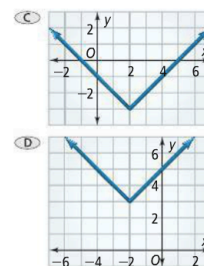
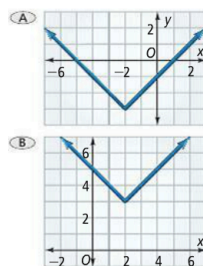
Question: Do transformations of the form  $y = |x| + k$  affect the axis of symmetry? Explain.

Ex. Graph  $y = |x - 3|$

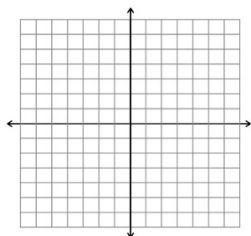


Key Concept The Family of Absolute Value Functions	
Parent Function $y =  x $	
<b>Vertical Translation</b> Translation up $k$ units, $k > 0$ $y =  x  + k$ Translation down $k$ units, $k > 0$ $y =  x  - k$	<b>Horizontal Translation</b> Translation right $h$ units, $h > 0$ $y =  x - h $ Translation left $h$ units, $h > 0$ $y =  x + h $
<b>Vertical Stretch and Compression</b> Vertical stretch, $a > 1$ $y = a x $ Vertical compression, $0 < a < 1$ $y = a x $	<b>Reflection</b> In the $x$ -axis $y = - x $ In the $y$ -axis $y =  -x $

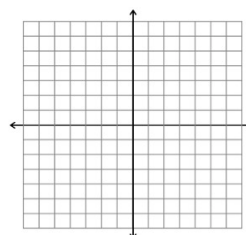
Ex. Which of the following is the graph of  $y = |x + 2| + 3$ ?



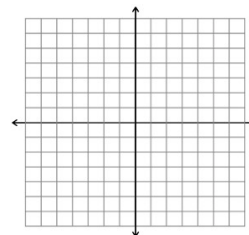
Ex. Graph  $y = |x - 2| + 1$ .



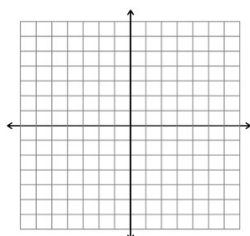
Ex. Graph  $y = \frac{1}{2}|x|$ .



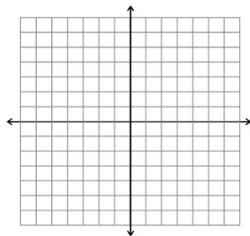
Ex. Graph  $y = 2|x|$



Ex. Graph  $y = -\frac{2}{3}|x|$



Ex. Graph  $y = -3|x + 4| - 1$



### Key Concept General Form of the Absolute Value Function

$$y = a|x - h| + k$$

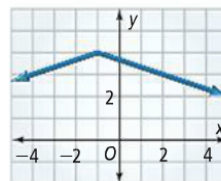
The stretch or compression factor is  $|a|$ , the vertex is located at  $(h, k)$ , and the axis of symmetry is the line  $x = h$ .

Ex. Without graphing, what are the vertex and axis of symmetry of the graph of  $y = 3|x - 2| + 4$ ? How is the parent function  $y = |x|$  transformed?

Ex. What are the vertex and axis of symmetry of

$y = -2|x - 1| - 3$ ? How is  $y = |x|$  transformed?

Ex. What is the equation of the absolute value function?



Ex. What is the equation of the absolute value function?

