

# 3.21

## Graphing a Linear Equation with Absolute Value in the Plane

### • Example 1

Graph

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

If  $x \geq -1$ , then

$$|x + 1| = x + 1$$

and

$$y = 2|x + 1| - 1 = 2(x + 1) - 1 = 2x + 1.$$

Likewise, if  $x \leq -1$ , then

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

and

$$y = 2|x + 1| - 1 = -2(x + 1) - 1 = -2x - 3.$$

Thus,  $y$  is given by the two half lines

$$y = 2x + 1 \text{ when } x \geq -1$$

and

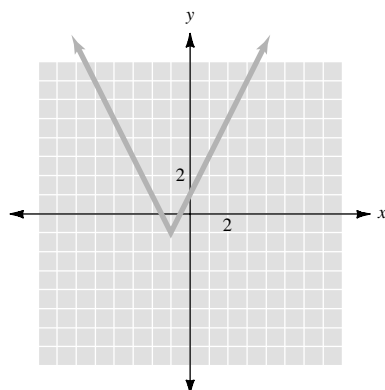
$$y = -2x - 3 \text{ when } x \leq -1.$$

The two half-lines have a common origin whose  $x$ -coordinate is  $-1$ . Indeed, we have

$$2 \cdot (-1) + 1 = -1$$

$$-2 \cdot (-1) - 3 = -1.$$

The origin of the half-line is thus  $(-1, -1)$ . They are plotted in the graph below.



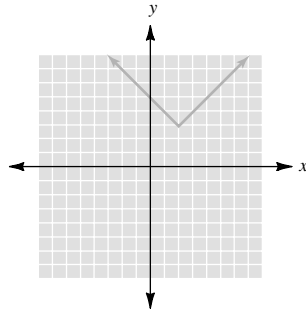
● ● ● CHECK YOURSELF 1

Graph  
 $y = |x - 2| + 3$ .

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● ● ● CHECK YOURSELF ANSWER

1.



# 3.21 Exercises

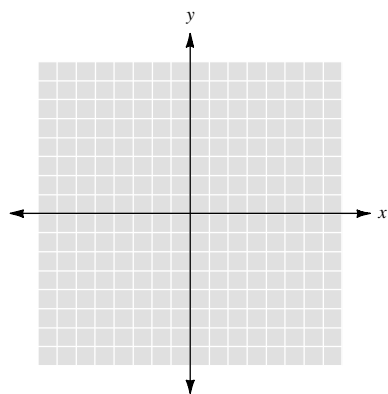
Name \_\_\_\_\_

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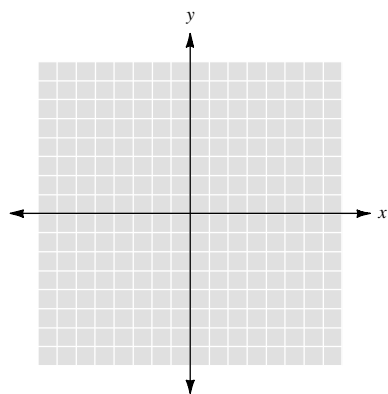
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Graph.

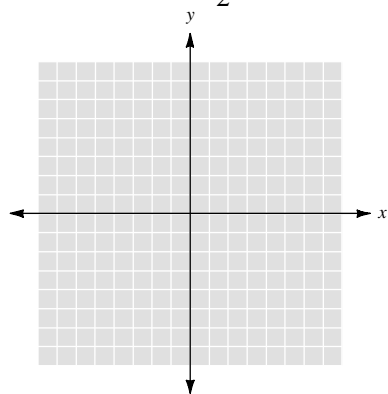
1.  $y = |x| + 3$



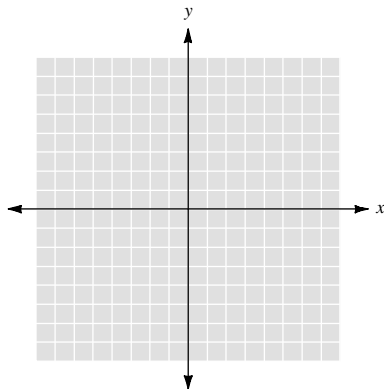
2.  $y = |x| - 5$



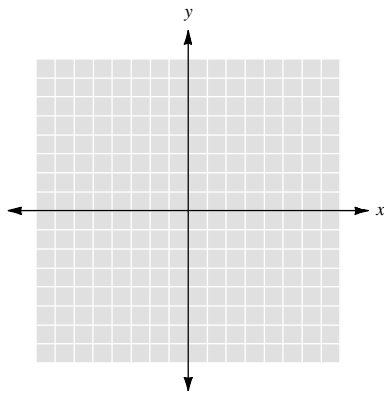
3.  $y = |x - 2| + \frac{7}{2}$



4.  $y = 3|x - 5| - 3$



5.  $y = -4|x + 2| + 4$



6.  $y = -|x + 4| + 2$

