

# Objective

Students will be able to represent relations and functions, explain whether the relation is a function or not, identify input and output as domain and range, and find the slope and rate of change of a line.

# Represent Relations and Functions

A relation is a mapping, or pairing, of input values with output values. The set of input values is the domain, and the set of output values is the range.

## Representing Relations

A relation can be represented in the following ways.

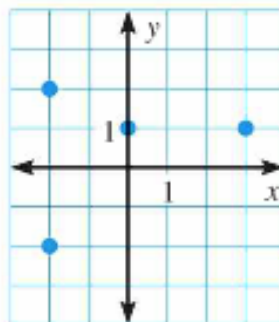
### Ordered Pairs

$(-2, 2)$   
 $(-2, -2)$   
 $(0, 1)$   
 $(3, 1)$

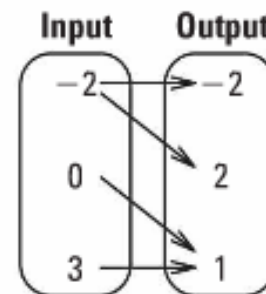
### Table

$x$	$y$
-2	2
-2	-2
0	1
3	1

### Graph



### Mapping Diagram



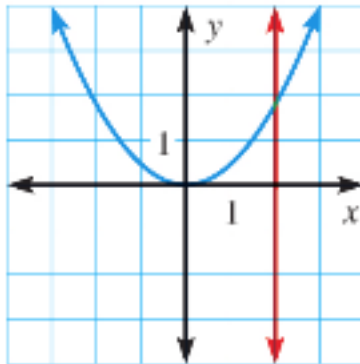
# Function

A function is a relation for which each input has exactly one output. If any input of a relation has more than one output, the relation is *not* a function.

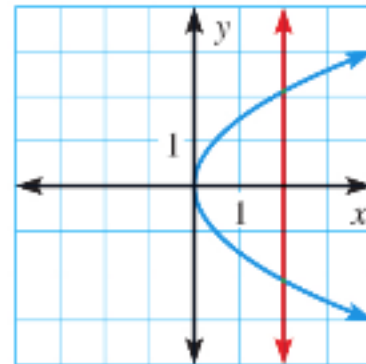
## Vertical Line Test

A relation is a function if and only if no vertical line intersects the graph of the relation at more than one point.

**Function**



**Not a function**



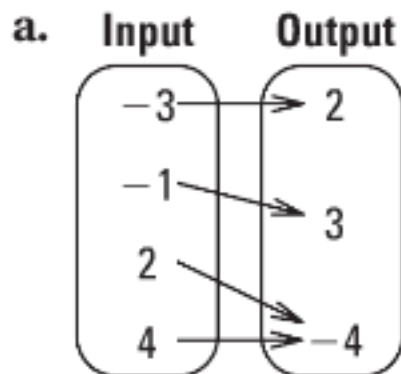
# Tell whether the following relations are functions or not.

1) Identify the domain and range of the relation given by the ordered pairs:  $(-4, 3)$ ,  $(-2, 1)$ ,  $(0, 3)$ ,  $(1, 2)$  and  $(-2, 4)$ . Is this relation a function?

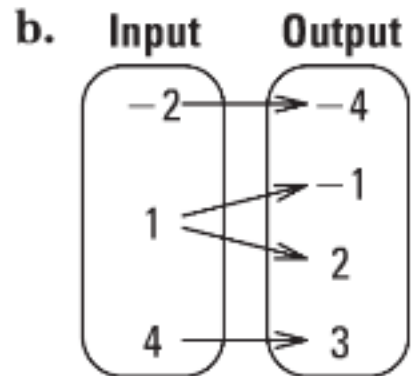
D:  $\{-4, -2, 0, 1\}$       R:  $\{1, 2, 3, 4\}$

No; the input  $-2$  has more than one output

2) Tell whether the relation is a function. Explain.



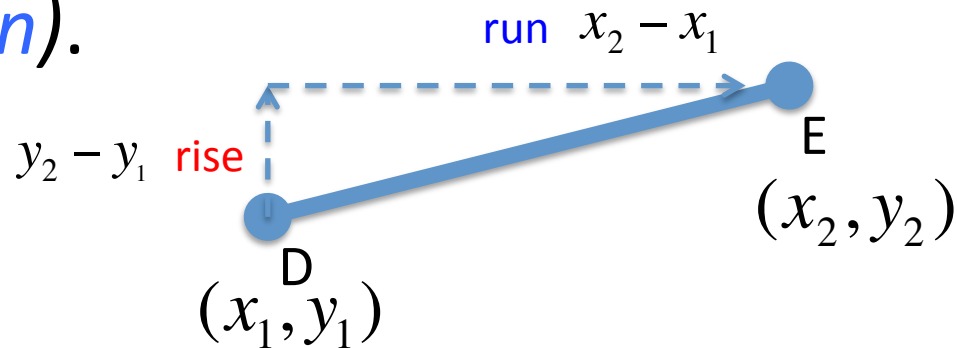
Yes; each input is mapped onto exactly one output



No; the input 1 is mapped onto both  $-1$  and  $2$

# Slope

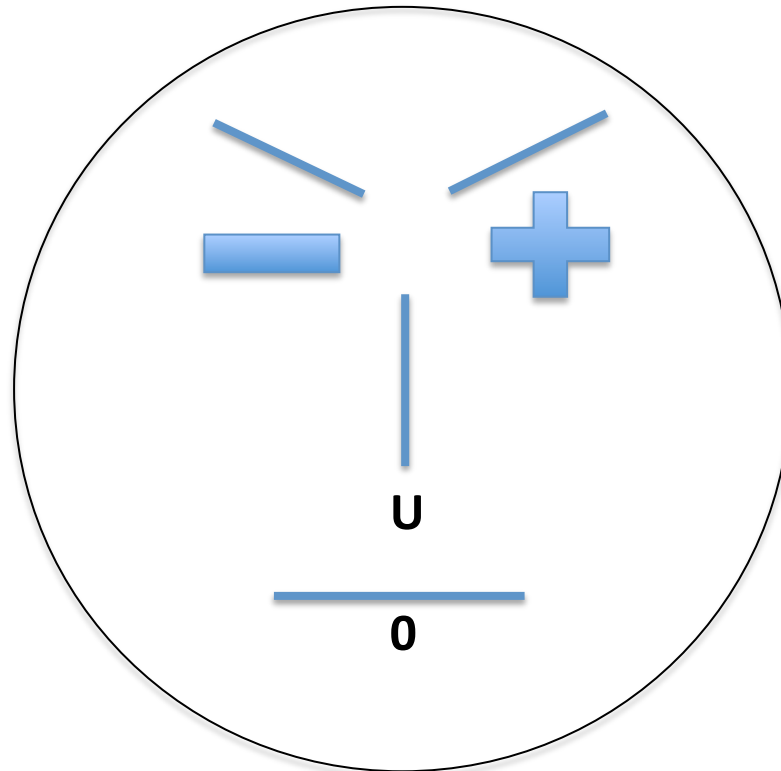
The slope  $m$  of a nonvertical line is the ratio of vertical change (*the rise*) to horizontal change (*the run*).



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

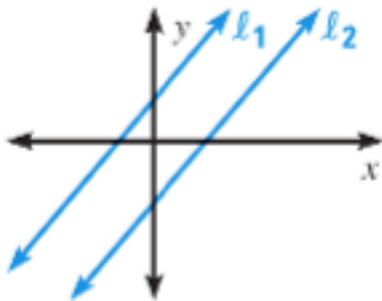
# Slope Man!

Classification of Lines by Slope

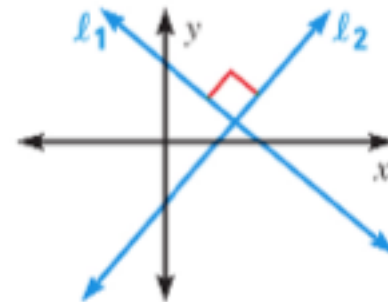


# Slopes of Parallel and Perpendicular Lines

## Parallel Lines



## Perpendicular Lines



What do we know about the slopes of parallel and perpendicular lines?

If given parallel lines,  
then they have the  
**same** slope.

If given perpendicular lines,  
then they have **opposite**  
**reciprocal** slopes.

# Scavenger Hunt

With a partner, pick a place to start in the room. Copy down the question that needs to be answered and then go back to your seat and solve the problem. Find the answer around the room and write down the letter that corresponds to that answer. Copy down the new problem on that sheet and solve. Continue doing so until you have solved all of the problems around the room and have “decoded” the message.



# Homework

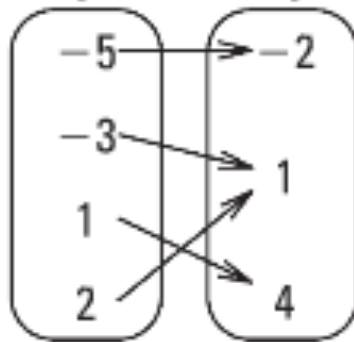
p. 77: 11-12, 18-19, 22-23

p. 86: 11-13, 21-22, 39

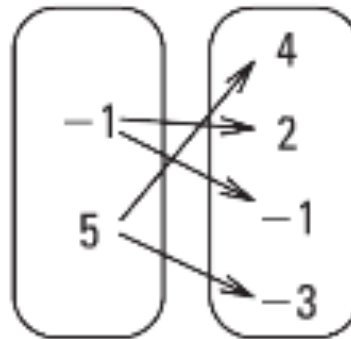
**p. 77: 11-12, 18-19, 22-23**

**IDENTIFYING FUNCTIONS** Tell whether the relation is a function. *Explain.*

11. Input Output



12. Input Output

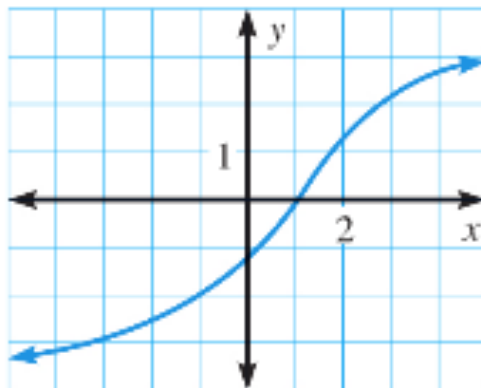


18.  $(0, 1), (1, 0), (2, 3), (3, 2), (4, 4)$

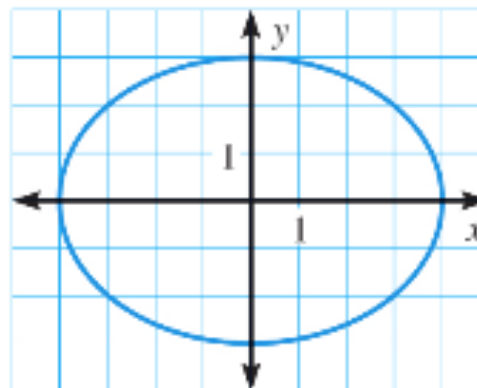
19.  $(-1, -1), (2, 5), (4, 8), (-5, -9), (-1, -5)$

**VERTICAL LINE TEST** Use the vertical line test to tell whether the relation is a function.

22.



23.



# Homework Contin. p. 77: 11-12, 18-19, 22-23

p. 86: 11-13, 21-22, 39

**p. 86: 11-13, 21-22, 39**

**FINDING SLOPE** Find the slope of the line passing through the given points. Then tell whether the line *rises, falls, is horizontal, or is vertical*.

11.  $(4, 4), (4, 9)$       12.  $(5, 5), (7, 3)$       13.  $(0, -3), (4, -3)$

**CLASSIFYING LINES** Tell whether the lines are *parallel, perpendicular, or neither*.

21. Line 1: through  $(5, 8)$  and  $(7, 2)$   
Line 2: through  $(-7, -2)$  and  $(-4, -1)$
22. Line 1: through  $(-3, 2)$  and  $(5, 0)$   
Line 2: through  $(-1, -4)$  and  $(3, -3)$

**CHALLENGE** Find the value of  $k$  so that the line through the given points has the given slope. Check your solution.

39.  $(-4, 2k)$  and  $(k, -5)$ ;  $m = -1$

# Objectives

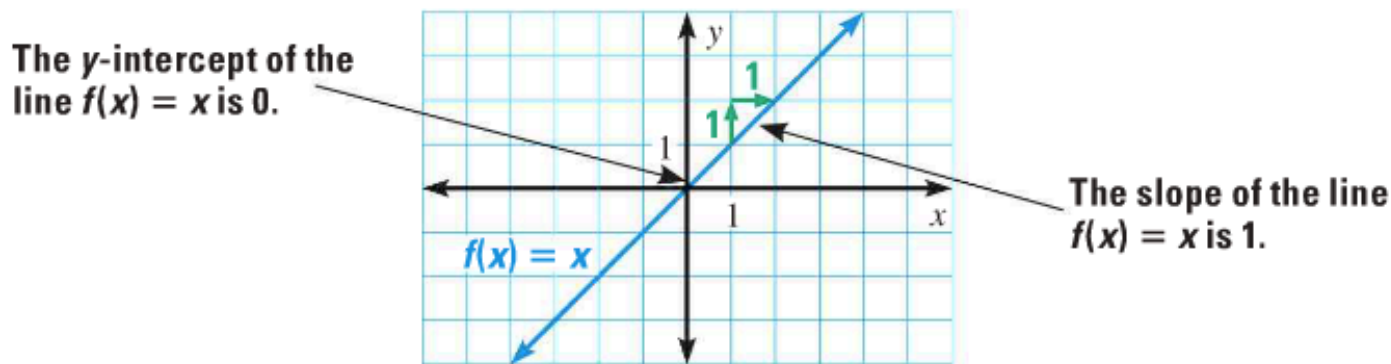
Students will be able to graph and write equations of lines.

# Graphing Equations of Lines

A *family* of functions is a group of functions with shared characteristics. The parent function is the most basic function in a family.

## Parent Function for Linear Functions

The parent function for the family of all linear functions is  $f(x) = x$ . The graph of  $f(x) = x$  is shown.



In general, a **y-intercept** of a graph is the y-coordinate of a point where the graph intersects the y-axis.

# Slope-Intercept Form

$$y = mx + b$$

## Using Slope-Intercept Form to Graph an Equation

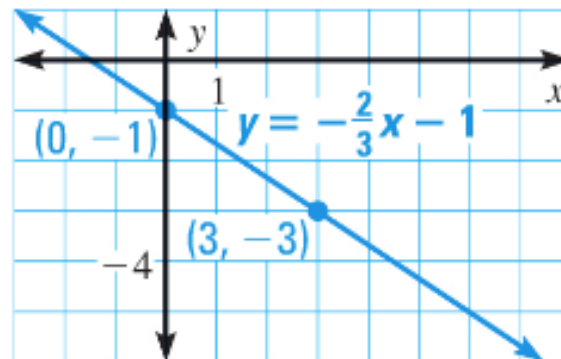
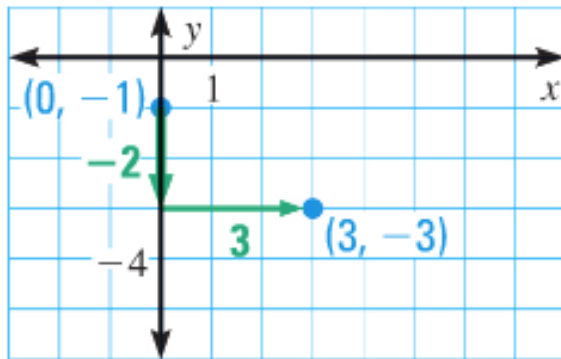
- STEP 1** Write the equation in slope-intercept form by solving for  $y$ .
- STEP 2** Identify the  $y$ -intercept  $b$  and use it to plot the point  $(0, b)$  where the line crosses the  $y$ -axis.
- STEP 3** Identify the slope  $m$  and use it to plot a second point on the line.
- STEP 4** Draw a line through the two points.

# Slope-Intercept Form Example

Graph  $y = -\frac{2}{3}x - 1$ .

## Solution

- STEP 1** The equation is already in slope-intercept form.
- STEP 2** **Identify** the y-intercept. The y-intercept is  $-1$ , so plot the point  $(0, -1)$  where the line crosses the y-axis.
- STEP 3** **Identify** the slope. The slope is  $-\frac{2}{3}$ , or  $\frac{-2}{3}$ , so plot a second point on the line by starting at  $(0, -1)$  and then moving down 2 units and right 3 units. The second point is  $(3, -3)$ .
- STEP 4** **Draw** a line through the two points.



# Standard Form

$$Ax + By = C$$

## Using Standard Form to Graph an Equation

- STEP 1** Write the equation in standard form.
- STEP 2** Identify the  $x$ -intercept by letting  $y = 0$  and solving for  $x$ . Use the  $x$ -intercept to plot the point where the line crosses the  $x$ -axis.
- STEP 3** Identify the  $y$ -intercept by letting  $x = 0$  and solving for  $y$ . Use the  $y$ -intercept to plot the point where the line crosses the  $y$ -axis.
- STEP 4** Draw a line through the two points.

# Standard Form Example

Graph  $5x + 2y = 10$ .

## Solution

**STEP 1** The equation is already in standard form.

**STEP 2** Identify the  $x$ -intercept.

$$5x + 2(\mathbf{0}) = 10 \quad \text{Let } y = 0.$$

$$x = 2 \quad \text{Solve for } x.$$

The  $x$ -intercept is 2. So, plot the point  $(2, 0)$

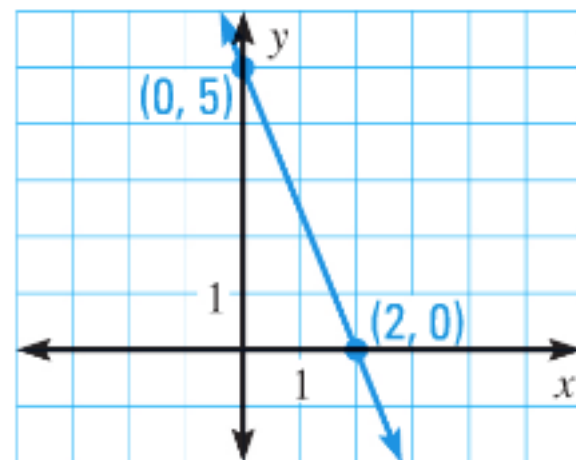
**STEP 3** Identify the  $y$ -intercept.

$$5(\mathbf{0}) + 2y = 10 \quad \text{Let } x = 0.$$

$$y = 5 \quad \text{Solve for } y.$$

The  $y$ -intercept is 5. So, plot the point  $(0, 5)$ .

**STEP 4** Draw a line through the two points.





# Horizontal and Vertical Lines

Horizontal Lines: The graph of  $y = c$  is the horizontal line through  $(0, c)$



Vertical Lines: The graph of  $x = c$  is the vertical line through  $(c, 0)$



# Forms of Linear Equations

Form	Equation	Key Facts
Slope-Intercept Form	$y = mx + b$	The graph is a line with slope $m$ and y-intercept $b$
Standard Form	$Ax + By = C$  ** $A$ , $B$ , and $C$ cannot be fractions and $A$ must be positive	The graph is a line with intercepts $x = C/A$ and $y = C/B$
Point-Slope Form	$y - y_1 = m(x - x_1)$	The graph is a line that has slope $m$ and passes through $(x_1, y_1)$ .

1) Write the equation of the line that passes through (3, 6) and has slope  $m = 2/3$ .

$$y = 2/3x + 4$$

2) Write the equation of the line that passes through (-2, 3) and is:

a) parallel to  $y = -4x + 1$

$$y = -4x - 5$$

b) perpendicular to  $y = -4x + 1$

$$y = 1/4x + 7/2$$

# Forms of Linear Equations

Write the equation of the line in standard form, point-slope form, and slope-intercept form that passes through the points (0, 6) and (2, 3).

Slope-intercept:  $y = -\frac{3}{2}x + 6$

Point-slope form:  $y - 3 = -\frac{3}{2}(x - 2)$

Standard form:  $3x + 2y = 12$

# Homework

p. 94: 44-47

p. 101: 7, 16, 23, 30, 43

p. 94: 44-47

**CHOOSING A METHOD** Graph the equation using any method.

44.  $-3 + x = 0$

45.  $y + 7 = -2x$

46.  $4y = 16$

47.  $8y = -2x + 20$

p. 101: 7, 16, 23, 30, 43

**SLOPE-INTERCEPT FORM** Write an equation of the line that has the given slope and y-intercept.

7.  $m = -\frac{5}{4}, b = 7$

**POINT-SLOPE FORM** Write an equation of the line that passes through the given point and has the given slope.

16.  $(-4, 2), m = \frac{3}{2}$

**PARALLEL AND PERPENDICULAR LINES** Write an equation of the line that passes through the given point and satisfies the given condition.

23.  $(4, 1)$ ; perpendicular to  $y = \frac{1}{3}x + 3$

**WRITING EQUATIONS** Write an equation of the line that passes through the given points.

30.  $(-1, 3), (2, 9)$

**STANDARD FORM** Write an equation in standard form  $Ax + By = C$  of the line that satisfies the given conditions. Use integer values for  $A$ ,  $B$ , and  $C$ .

43.  $m = \frac{4}{5}$ , passes through  $(2, 3)$

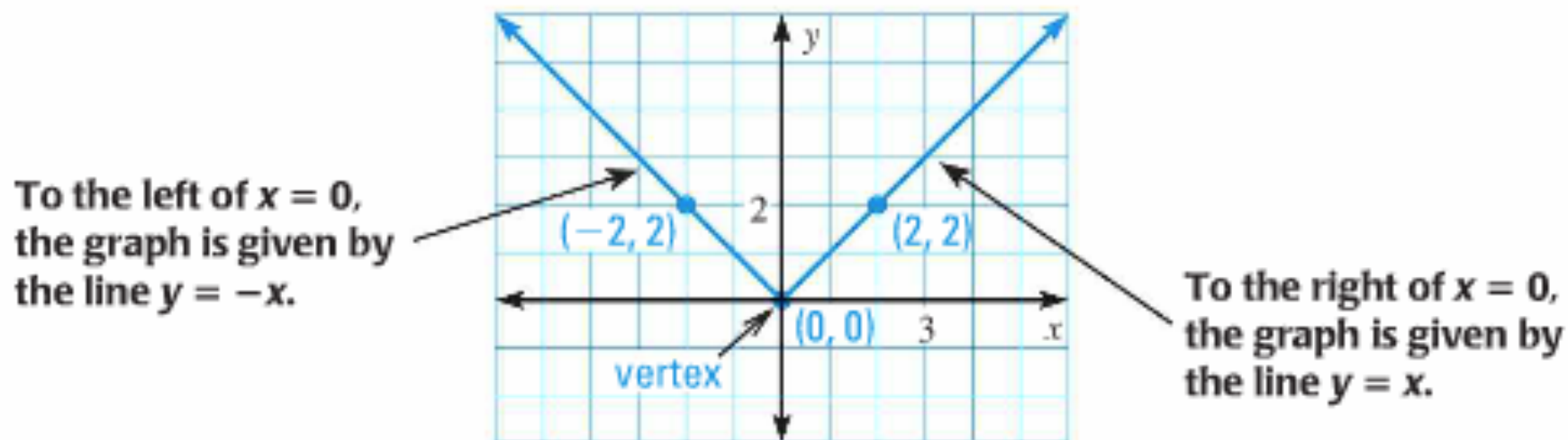
# Objective

Students will be able to graph and write absolute value equations.

# Absolute Value Functions

## Parent Function for Absolute Value Functions

The parent function for the family of all absolute value functions is  $f(x) = |x|$ . The graph of  $f(x) = |x|$  is V-shaped and is symmetric about the y-axis. So, for every point  $(x, y)$  on the graph, the point  $(-x, y)$  is also on the graph.



The highest or lowest point on the graph of an absolute value function is called the **vertex**. The vertex of the graph of  $f(x) = |x|$  is  $(0, 0)$ .

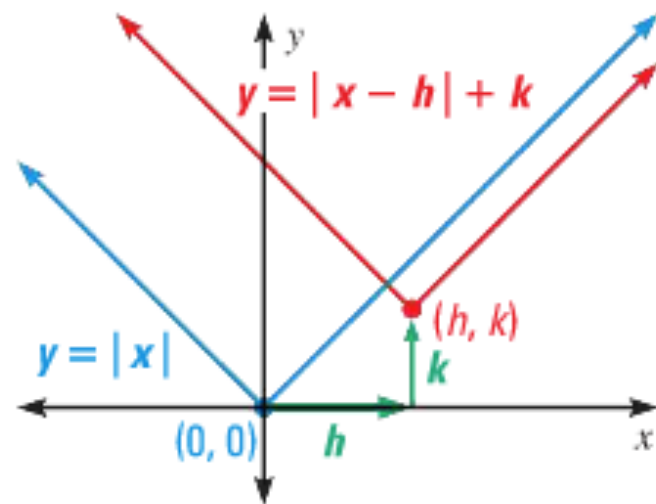
$$D: (-\infty, \infty)$$

$$R: [0, \infty)$$

# Translations

A transformation changes a graph's size, shape, position, or orientation. A translation is a transformation that shifts a graph horizontally, and/or vertically, but does not change its size, shape, or orientation.

The graph of  $y = a|x - h| + k$  is the graph of  $y = |x|$  translated  $h$  units horizontally and  $k$  units vertically. The vertex of  $y = a|x - h| + k$  is  $(h, k)$ .





1) Graph  $y = |x + 4| - 2$ . Compare the graph with the graph of  $y = |x|$ .

**Step 1: Identify** and plot the vertex,  $(h, k) = (-4, -2)$

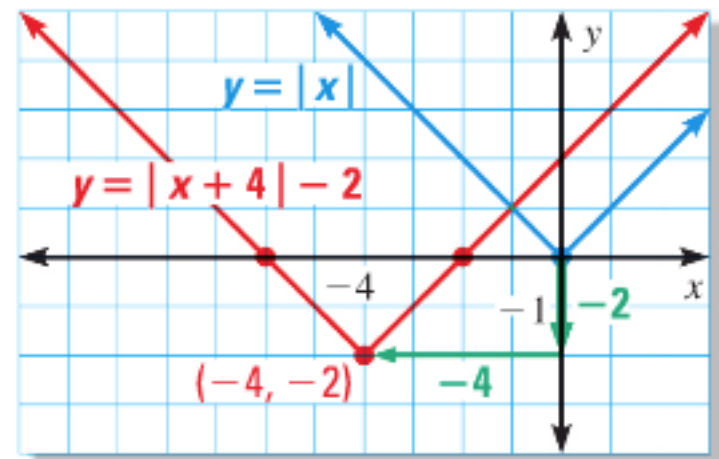
**Step 2: Plot** another point on the graph (you can plug in any value for  $x$  and see what you get  $y$  equal to; make sure to use one  $x$  value is to the **right** and to the **left** of **vertex**), such as  $(-2, 0)$ . Use symmetry to plot a third point,  $(-6, 0)$ .

**Step 3: Connect** the points with a V-shaped graph.

**Step 4: Compare** the graphs.

The graph of  $y = |x + 4| - 2$  is the graph  $y = |x|$  translated down 2 units and left 4 units

**D:**  $(-\infty, \infty)$       **R:**  $[-2, \infty)$



# Stretches, Shrinks, and Reflections

**STRETCHES, SHRINKS, AND REFLECTIONS** When  $|a| \neq 1$ , the graph of  $y = a|x|$  is a vertical *stretch* or a vertical *shrink* of the graph of  $y = |x|$ , depending on whether  $|a|$  is less than or greater than 1.

For $ a  > 1$	For $ a  < 1$
<ul style="list-style-type: none"><li>• The graph is vertically <i>stretched</i>, or elongated.</li><li>• The graph of <math>y = a x </math> is <i>narrower</i> than the graph of <math>y =  x </math>.</li></ul>	<ul style="list-style-type: none"><li>• The graph is vertically <i>shrunk</i>, or compressed.</li><li>• The graph of <math>y = a x </math> is <i>wider</i> than the graph of <math>y =  x </math>.</li></ul>

When  $a = -1$ , the graph of  $y = a|x|$  is a **reflection** in the  $x$ -axis of the graph of  $y = |x|$ . When  $a < 0$  but  $a \neq -1$ , the graph of  $y = a|x|$  is a vertical stretch or shrink with a reflection in the  $x$ -axis of the graph of  $y = |x|$ .

$a$  is like the “slope” of an absolute value; start at vertex and move to the right like it’s the slope and reflect to the other side

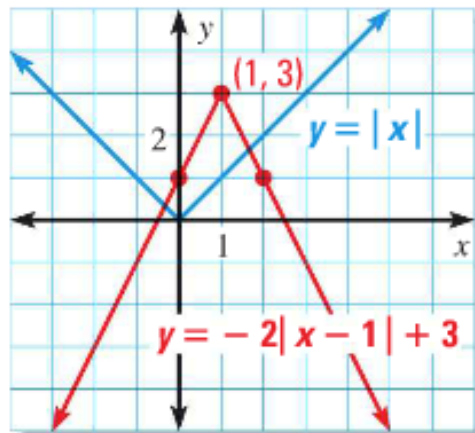
2) Graph  $y = -2|x - 1| + 3$ .

**Step 1: Identify** and plot the vertex,  $(h, k) = (1, 3)$

**Step 2: Plot** another point on the graph (you can plug in any value for  $x$  and see what you get  $y$  equal to; make sure to use one  $x$  value is to the **right** and to the **left** of **vertex**), such as  $(0, 1)$ . Use symmetry to plot a third point,  $(2, 1)$ .

Can also use  $a$  value like the “slope” of an absolute value; start at vertex and move to the right like it’s the slope and reflect to the other side

**Step 3: Connect** the points with a V-shaped graph.



$$D: (-\infty, \infty)$$

$$R: (-\infty, 3]$$

# Homework

## Graphing Absolute Value Equations WS

# Objective

Students will be able to graph linear and absolute value inequalities.

Math tutoring during lunch and after school in room 341 is now available!

# Graphing Inequalities

## Graphing a Linear Inequality

To graph a linear inequality in two variables, follow these steps:

- STEP 1** **Graph** the boundary line for the inequality. Use a dashed line for  $<$  or  $>$  and a solid line for  $\leq$  or  $\geq$ .
- STEP 2** **Test** a point *not* on the boundary line to determine whether it is a solution of the inequality. If it is a solution, shade the half-plane containing the point. If it is not a solution, shade the other half-plane.

$(0, 0)$  is a great option to test if it does not lie on the line; if the statement is true when you plug in  $(0, 0)$ , then shade in that area

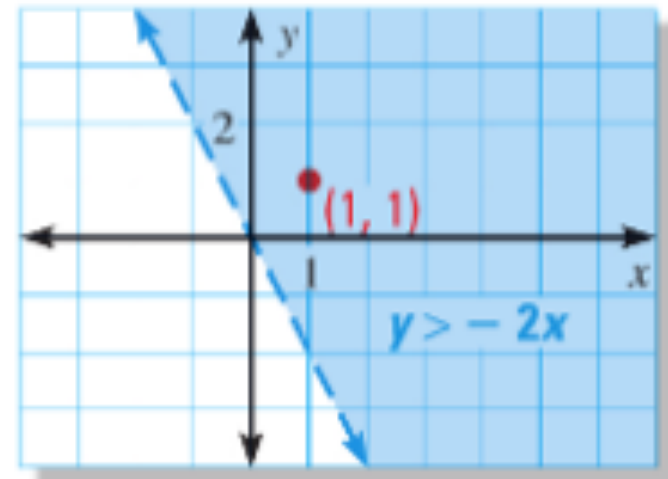
The same steps apply for graphing absolute value inequalities

\*\*\*be careful when you are rearranging your inequality to graph—negatives flip the inequality sign

# 1) Graph $y > -2x$ in a coordinate plane.

**Step 1:** **Graph** the boundary line  $y = -2x$ . Use a dashed line because the inequality symbol is  $>$  (not equal to).

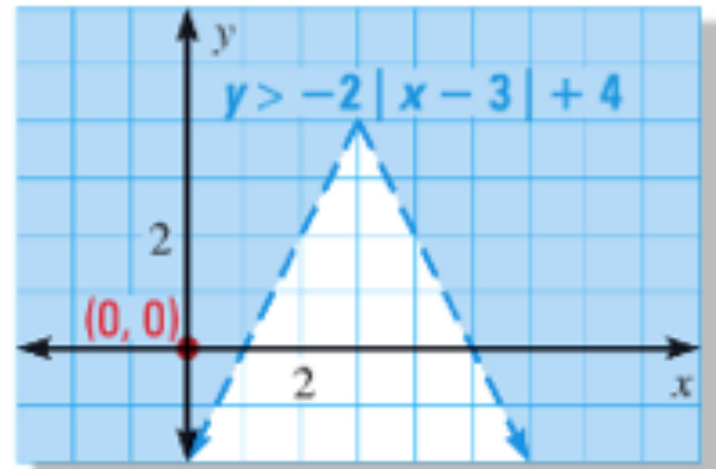
**Step 2:** **Test** a point to see where to shade. Since  $(0, 0)$  is on the boundary line, we need to try a different point. If we test  $(1, 1)$ , we see that it produces a true statement and therefore it is a solution to the inequality and we want to shade the side with that point.



2) Graph  $y > -2|x - 3| + 4$  in a coordinate plane.

**Step 1:** **Graph** the equation of the boundary,  $y > -2|x - 3| + 4$ . Use a dashed line because the inequality symbol is  $>$  (not equal to).

**Step 2:** **Test** a point to see where to shade. Since  $(0, 0)$  is *not* the boundary line, we can test it. If we test  $(0, 0)$ , we see that it produces a true statement and therefore it is a solution to the inequality and we want to shade the area with that point (outside the absolute value graph).





# Homework

Graphing Inequalities worksheet

Go through summer packets and circle anything that you still have a question about and we will go through it tomorrow

**TEST** over Chapters 1 and 2 **Wednesday-**  
**NO CALCULATOR**

Answer key to summer packet, class notes, and the code for the online textbook on my website

**Math tutoring during lunch and after school in room 341 is now available!**