

## Activity: Graphing Absolute Value Functions

With a partner, complete the 2.8 Graphing Absolute Value Functions Activity.

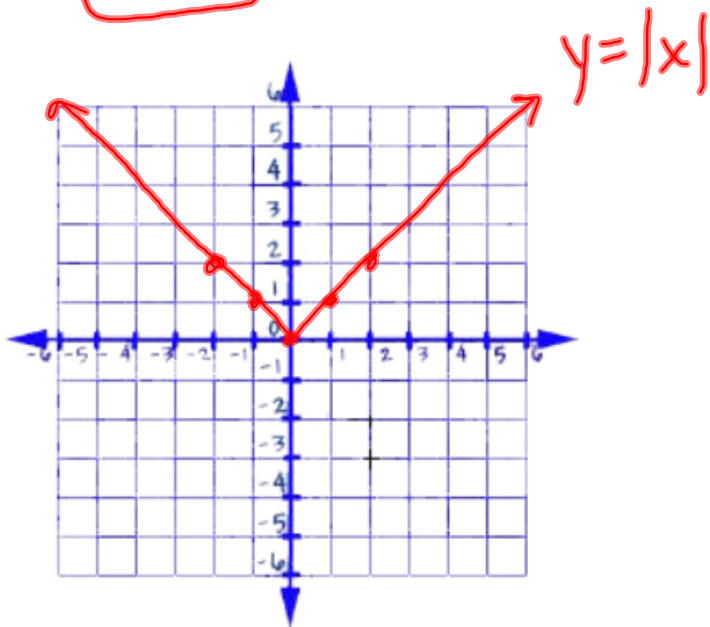
You will need:

- A partner
- Activity sheet
- Pencil
- Graphing calculator

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

1. Graph  $y = |x|$  using the following table of values

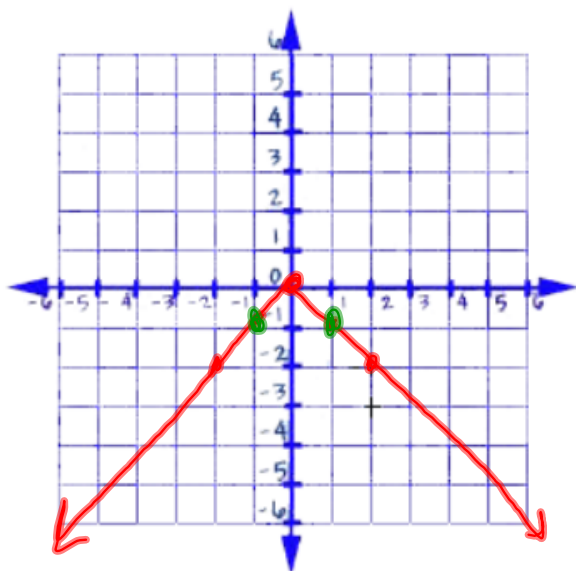
$$y = a|x - h| + k$$



x	y
-2	2
-1	1
0	0
1	1
2	2

Graph  $y = -|x|$  using the following table of values:

$$y = -|x|$$



x	y
-2	-2
-1	-1
0	0
1	-1
2	-2

**Graphing Absolute Value functions on a TI-83:**  $y = a|x - h| + k$

You can find the absolute value function by accessing the **Math** key. Arrow to the right to find the **NUM** menu. On this screen you will find: **#1 abs(** the absolute value function:

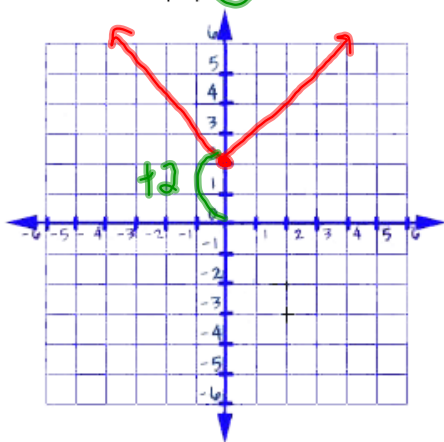


2. Graph  $y = |x|$  using your calculator and leave the equation in  $y_1$  for the rest of the activity.

**3. THE EFFECT OF  $k$ :**  $y = a|x - h| + k$

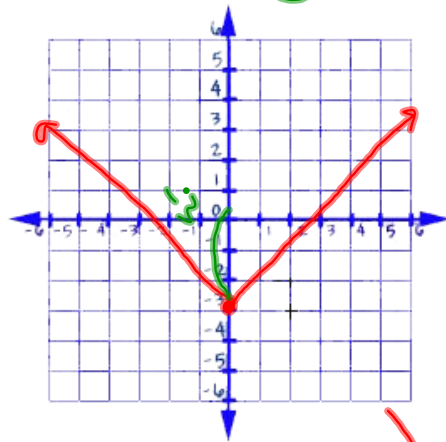
Graph the following functions and identify the vertex

a.  $y = |x| + 2$



Vertex (0, 2)

b.  $y = |x| - 3$



Vertex (0, -3)

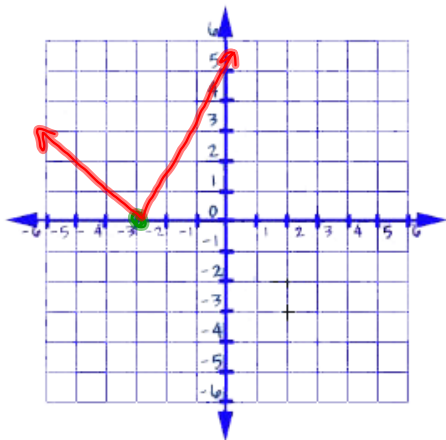
Describe the effect of  $k$  on the graph:

Shift the graph up or down

**4. THE EFFECT OF  $h$ :**  $y = a|x-h| + k$

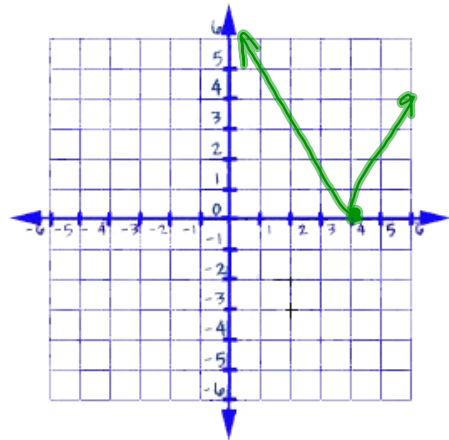
Graph the following functions and identify

a.  $y = |x+3|$



Vertex  $(-3, 0)$

b.  $y = |x-4|$



Vertex  $(4, 0)$

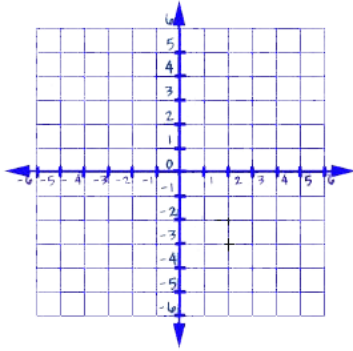
Describe the effect of  $h$  on the graph:

Shifts to the left or right

**5. THE EFFECT OF  $a$ :**  $y = a|x - h| + k$

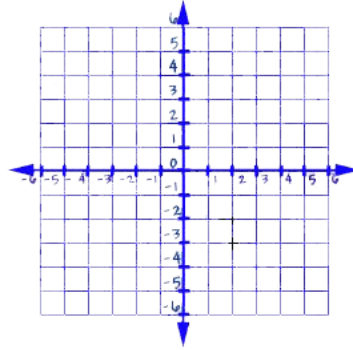
Graph the following functions and identify the vertex:

a.  $y = \frac{1}{3}|x|$



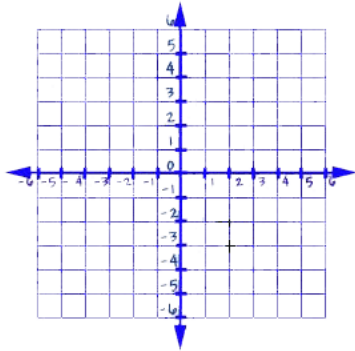
Vertex \_\_\_\_\_

b.  $y = 4|x|$



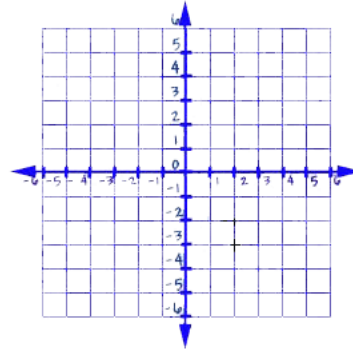
Vertex \_\_\_\_\_

c.  $y = -\frac{1}{2}|x|$



Vertex \_\_\_\_\_

d.  $y = -2|x|$



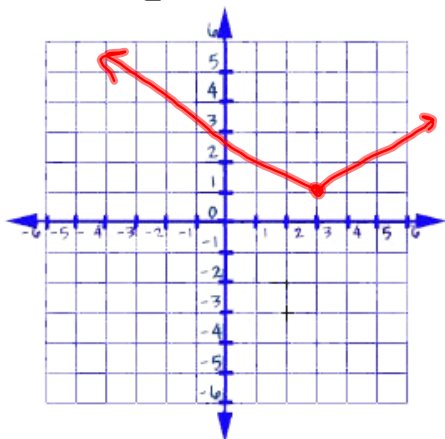
Vertex \_\_\_\_\_

Describe the two effects of  $a$  on the graph:

1. Narrower  $|a| > 1$
2. Wider  $|a| < 1$

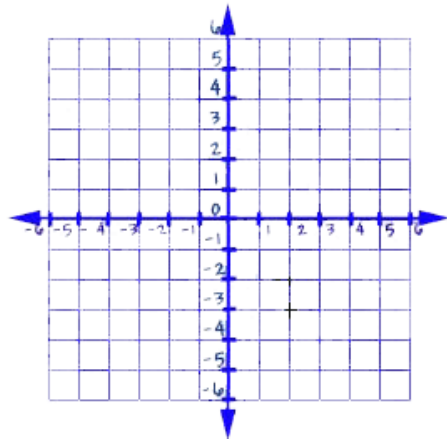
6. Putting it all together...graph the following functions and identify the vertex.

a.  $y = \frac{1}{2}|x - 3| + 1$



Vertex (3, 1)

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



Vertex \_\_\_\_\_

7. WITHOUT graphing, can you figure out the vertex of the following function?

$$y = 3|x + 1| - 2$$

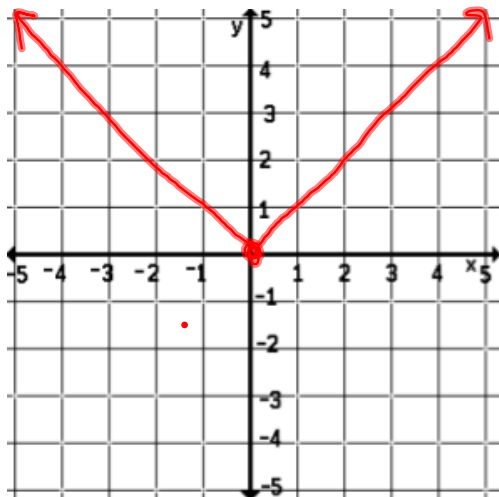
Vertex  $(-1, -2)$

$(h, k)$



## 2.8 Graphing Absolute Value Functions

Graph  $|x| = \begin{cases} x, & \text{if } x > 0 \\ 0, & \text{if } x = 0 \\ -x, & \text{if } x < 0 \end{cases}$



The graph is a piecewise function that consists of two rays and is V-shaped.

It opens up.

The corner point of the graph is called the vertex. In this case, it occurs at the origin.

Notice that the graph of  $y = |x|$  is symmetric in the y-axis because for every point  $(x,y)$  on the graph, the point  $(-x,y)$  is also on the graph.

General form of an absolute value function is  $y = a|x - h| + k$

- The graph has **vertex**  $(h,k)$  and is symmetric in the line  $x = h$
- The graph is **V-shaped**
- If  $a < 0$ , the graph **opens down** (a is negative)
- If  $a > 0$ , the graph **opens up** (a is positive)
- The graph is **wider** than the graph of  $y = |x|$  if  $|a| < 1$
- The graph is **narrower** than the graph of  $y = |x|$  if  $|a| > 1$



Note: When graphing, "**a**" is the **slope** to the **RIGHT** of the **vertex**

For examples 1 & 2 tell if the graph opens up or down, and if it is narrower or wider. State the vertex.

Example 1:  $y = 6|x - 7| + 0$

Vertex (7, 0)

Open up

Narrower

Example 2:  $y = |x| + 9$

Vertex (0, 9)

Opens up

Normal

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

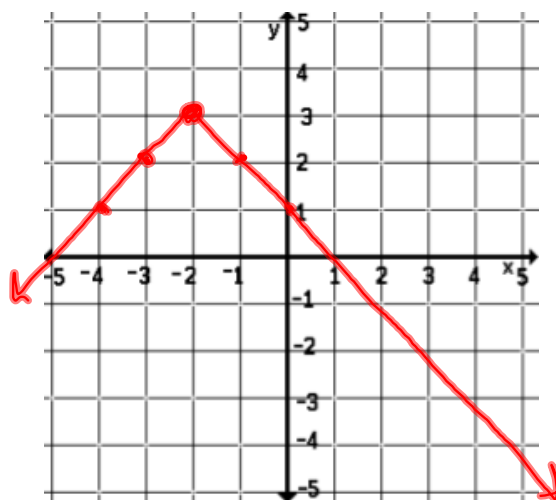
1. Plot the vertex  $(h,k)$
2. Use the slope  $(a)$  to plot another point to the RIGHT of the vertex.
3. Use symmetry to plot a 3rd point
4. Complete the graph

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

Vertex  $(-2, 3)$

Slope =  $-1$

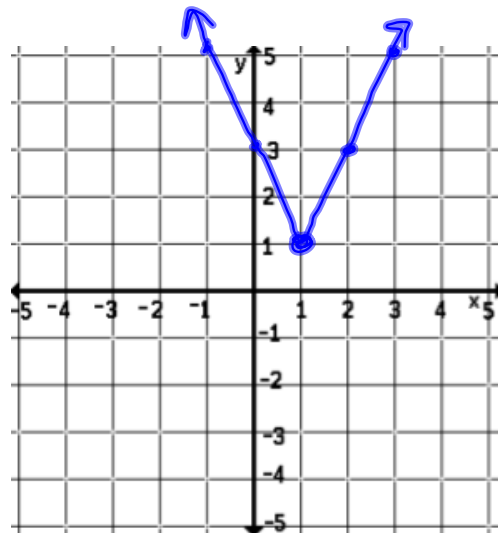
↑  
to the right



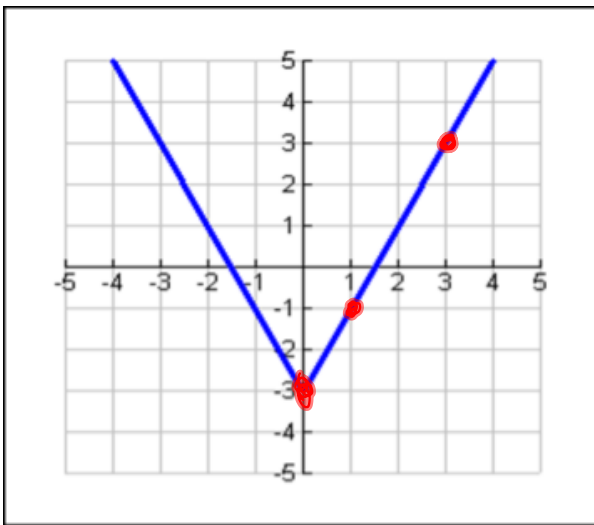
Graph  $y = 2|x - 1| + 1$

Vertex  $(1, 1)$

Slope = 2



Example 3: Write the equation for



Vertex  $(0, -3)$

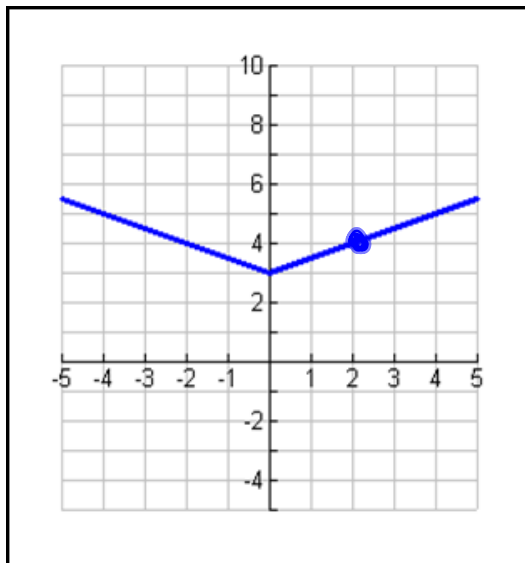
$$\text{Slope} = \frac{2}{1} = 2$$

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

$$y = 2|x-0| + (-3)$$

$$y = 2|x| - 3$$

Example 4: Write the equation for



Vertex  $(0, 3)$

Slope =  $\frac{1}{2}$

$$y = \frac{1}{2}|x| + 3$$



Take out your student handbook and write down  
the homework assignment:

pg. 125-126 #12-17, 19-25 odd, 34-39

