

## Learning How Absolute Value Changes a Function

The absolute value of a number is the distance a number is from the origin (zero). Distance is always positive so the absolute value of any number is positive. If  $x$  is a number then the absolute value of  $x$  is written  $|x|$ .

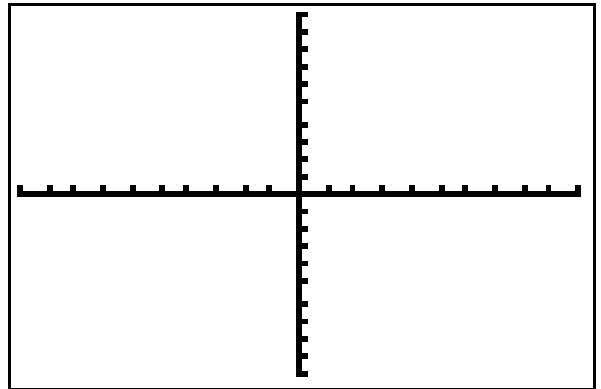
Enter each pair of equations in the calculator. Set  $y_1$  to be a thin line and  $y_2$  to be a bold line. Graph each pair of functions.

- Make a sketch of the two graphs.
- Notice that sometimes  $y_1$  and  $y_2$  are exactly the same. Describe when they are the same.
- Notice that other times  $y_1$  and  $y_2$  are different. Describe when they are different.
- $y_2$  can be written as a piecewise function. Write the two equations for  $y_2$ .

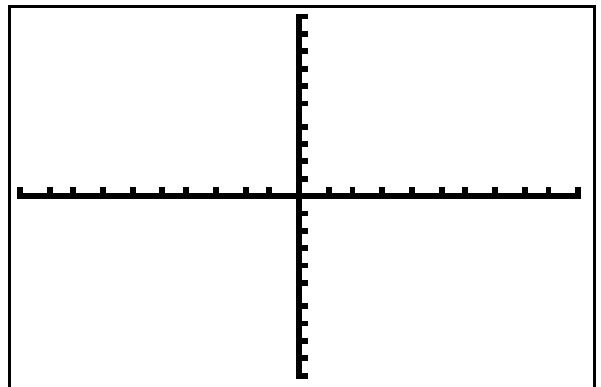
$$y_2 = \begin{cases} \quad \quad \quad , & \text{when } x \\ \quad \quad \quad , & \text{when } x \end{cases}$$

- Describe how the graph of  $y_1$  changed by placing it in an absolute value.

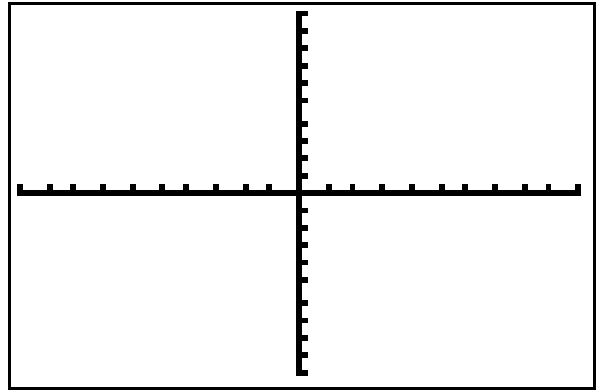
1.  $y_1 = x$   
 $y_2 = |x|$



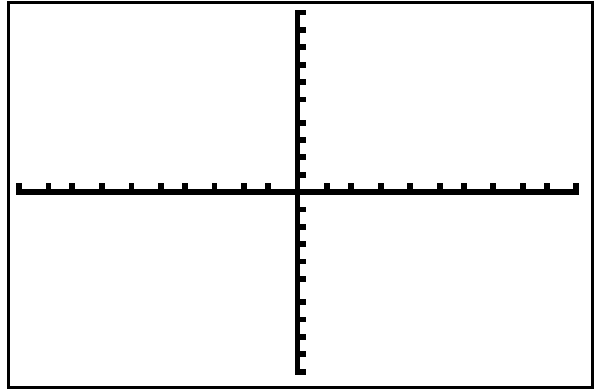
2.  $y_1 = 2x - 2$   
 $y_2 = |2x - 2|$



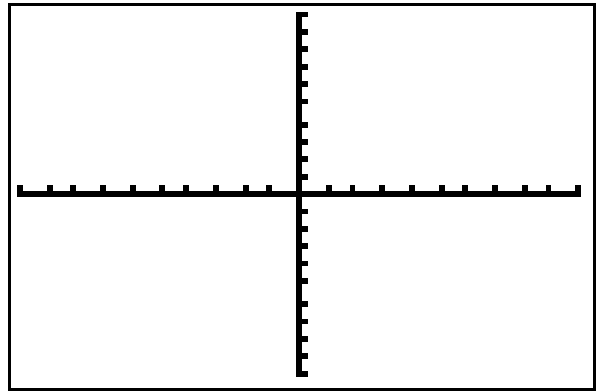
3.  $y_1 = 3x + 3$   
 $y_2 = |3x + 3|$



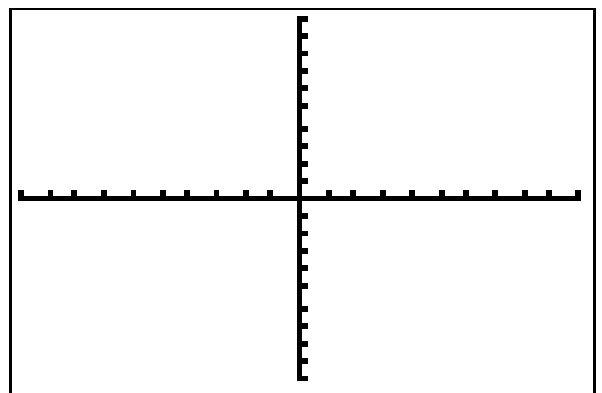
4.  $y_1 = x^2 - 4$   
 $y_2 = |x^2 - 4|$



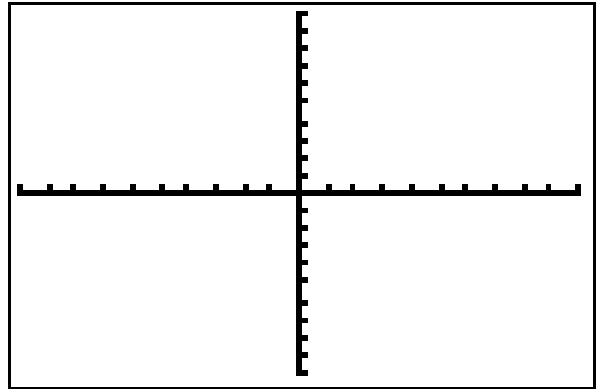
5.  $y_1 = 9 - x^2$   
 $y_2 = |9 - x^2|$



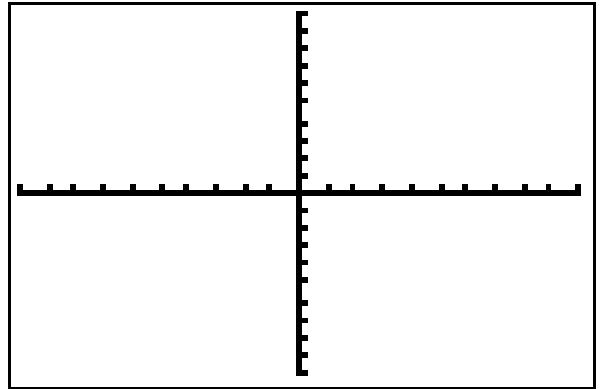
6.  $y_1 = x^3$   
 $y_2 = |x^3|$



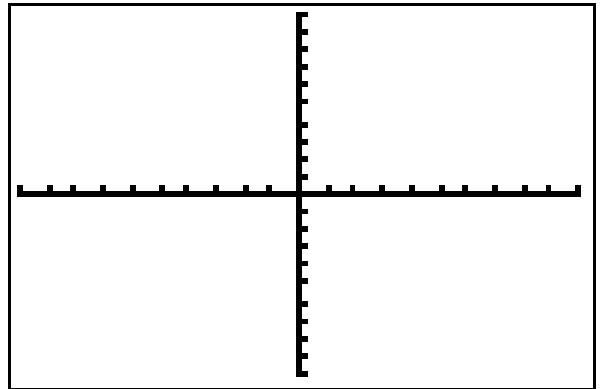
$$7. \quad \begin{aligned} y_1 &= x^3 - 2 \\ y_2 &= |x^3 - 2| \end{aligned}$$



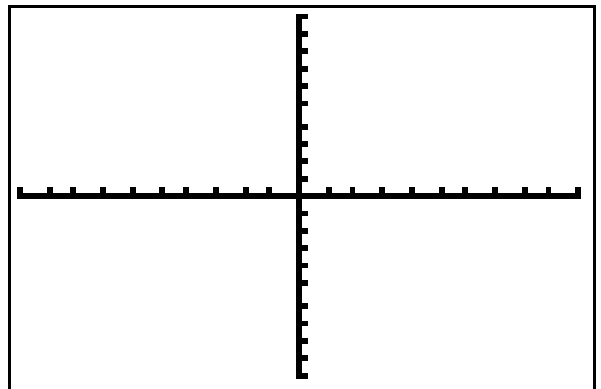
$$8. \quad \begin{aligned} y_1 &= 3 - x^3 \\ y_2 &= |3 - x^3| \end{aligned}$$



$$9. \quad \begin{aligned} y_1 &= x^2 - 7x - 8 \\ y_2 &= |x^2 - 7x - 8| \end{aligned}$$



$$10. \quad \begin{aligned} y_1 &= 6 - 5x - x^2 \\ y_2 &= |6 - 5x - x^2| \end{aligned}$$



When a function is placed in an absolute value the graph of the function changes. Summarize what you have learned by completing the 10 sets of equations above.

Try to write the piecewise function for the following set absolute value function.

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

Describe how you determined the two functions to use in your piecewise description.

Try to write the piecewise function for the following set absolute value function.

$$y = |x^2 - 16|.$$

Describe how you determined the two functions to use in your piecewise description.