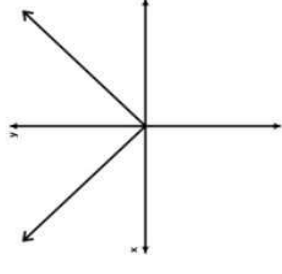


**Parent Function**

$$f(x) = |x|$$

# Transformations of

## Absolute Value Functions



Blank box for notes related to the parameter  $a$ .

$$g(x) = a|b(x - c)| + d$$

Blank box for notes related to the parameter  $c$ .

Blank box for notes related to the parameter  $b$ .

Blank box for notes related to the parameter  $d$ .

## Transformation Rules for Functions

Function Notation	Description of Transformation	Change to Coordinate Point
$f(x) + d$	Vertical Translation up $d$ units	$(x, y) \rightarrow (x, y + d)$
$f(x) - d$	Vertical translation down $d$ units	$(x, y) \rightarrow (x, y - d)$
$f(x + c)$	Horizontal translation left $c$ units	$(x, y) \rightarrow (x - c, y)$
$f(x - c)$	Horizontal translation right $c$ units	$(x, y) \rightarrow (x + c, y)$
$-f(x)$	Reflection over the $x$ -axis	$(x, y) \rightarrow (x, -y)$
$f(-x)$	Reflection over the $y$ -axis	$(x, y) \rightarrow (-x, y)$
$af(x)$	Vertical Stretch for $ a  > 1$	$(x, y) \rightarrow (x, ay)$
	Vertical Compression for $0 <  a  < 1$	
$f(bx)$	Horizontal Compression for $ b  > 1$	$(x, y) \rightarrow \left(\frac{x}{b}, y\right)$
	Horizontal Stretch for $0 <  b  < 1$	

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# Transformations of Absolute Value Functions I

**Transformations** can be applied to the parent graph  $f(x) = |x|$  just like any other function by changing the values of  $a$ ,  $b$ ,  $c$ , and  $d$  in the function

$$f(x) = a|b(x - c)| + d$$

**Example 1:** If  $f(x) = |x|$  and  $g(x) = f(x) + 2$ , determine what operations must be performed on  $x$  or  $y$ , create a table for  $g(x)$ , sketch, and then describe the transformation.

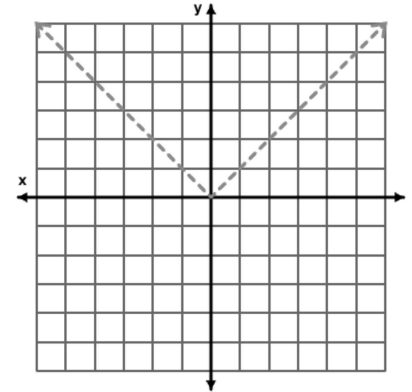
To obtain  $g(x)$ ,

\_\_\_\_\_

\_\_\_\_\_

$x$	$f(x)$	$x$	$g(x)$
-4	4	-4	
0	0	0	
4	4	4	

Transformation:



**Example 2:** If  $f(x) = |x|$  and  $g(x) = f(x - 2)$ , determine what operations must be performed on  $x$  or  $y$ , create a table for  $g(x)$ , sketch, and then describe the transformation.

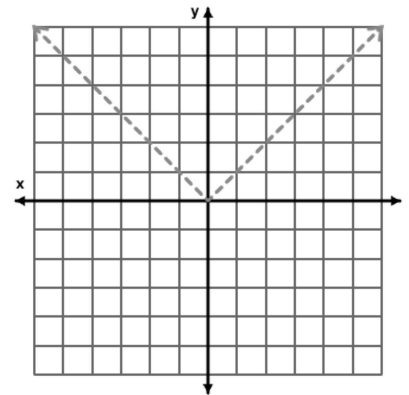
To obtain  $g(x)$ ,

\_\_\_\_\_

\_\_\_\_\_

Transformation:

$x$	$f(x)$	$x$	$g(x)$
-4	4		4
0	0		0
4	4		4



**Example 3:** If  $f(x) = |x|$  and  $g(x) = -f(x)$ , and  $h(x) = f(-x)$ , determine what operations must be performed on  $x$  or  $y$ , create a table for  $g(x)$  and  $h(x)$ , sketch, and then describe the transformation.

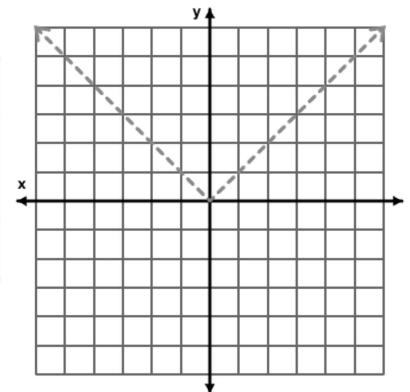
To obtain  $g(x)$ , \_\_\_\_\_

\_\_\_\_\_

To obtain  $h(x)$ : \_\_\_\_\_

\_\_\_\_\_

$x$	$f(x)$	$x$	$g(x)$	$x$	$h(x)$
-4	4	-4			4
0	0	0			0
4	4	4			4



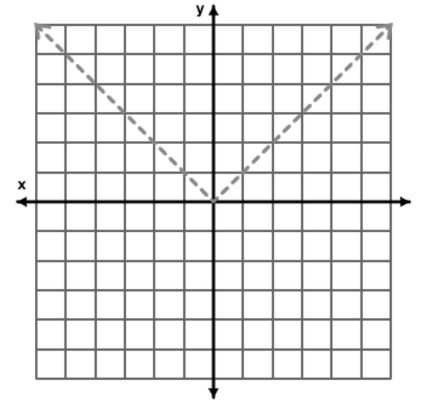
Transformations:

**Example 4:** If  $f(x) = |x|$  and  $g(x) = \frac{1}{2}f(x)$ , determine what operations must be performed on  $x$  or  $y$ , create a table for  $g(x)$ , sketch, and then describe the transformation.

To obtain  $g(x)$ , \_\_\_\_\_

x	f(x)
-4	4
0	0
4	4

x	g(x)
-4	
0	
4	



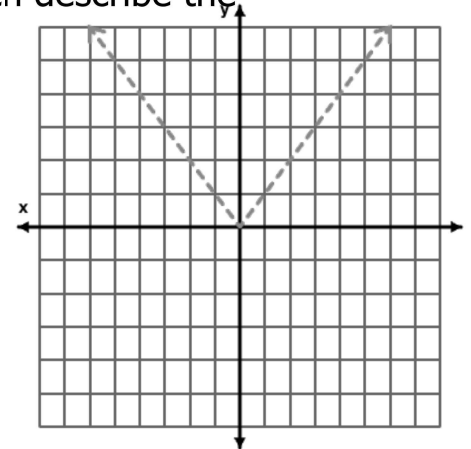
Transformation:

**Example 5:** If  $f(x) = |x|$  and  $h(x) = f(\frac{1}{2}x)$ , determine what operations must be performed on  $x$  or  $y$ , create a table for  $g(x)$ , sketch, and then describe the transformation.

To obtain  $h(x)$ , \_\_\_\_\_

x	f(x)
-4	4
0	0
4	4

x	h(x)
	4
	0
	4



Transformation:

**Example 6:** An absolute value function,  $f$ , has a vertex of  $(6, -2)$ . What would the new vertex be if  $f$  is transformed according to the rules below?

a)  $g(x) = f(x + 5)$

b)  $g(x) = 2f(x)$

c)  $g(x) = f(2x)$

New Vertex:

New Vertex:

New Vertex: