

This goes in the function family album.

Function Family Name: **Absolute Value**

General Equation in Standard Form:

$$f(x) = a|x-h| + k$$

Variable Meanings:

$h = \text{horizontal shift}$ $k = \text{vertical shift}$

General Graph Shape: $a = \text{vertical stretch or shrink (reflection if negative)}$

When $a > 1$:

$$\text{or } a < -1$$

When $a < 1$:

$$-1 < a < 1$$

vertical stretch -
(steeper than parent graph)
(gets narrower)

vertical shrink -
(flatter than parent graph)
(gets wider)

$a < 0$
reflected in x-axis
(turns upside-down)

General Table Characteristics:

Symmetric on each side of the vertex.

x	...	-3	-2	-1	0	1	2	3	...
f(x)		3	2	1	0	1	2	3	

Domain & Range:

Domain: any Real

Range: for $f(x) = |x|$

$$f(x) \geq 0$$

Asymptotes:

None

Example:

A car's speedometer reads 60 miles per hour. The error E in this measurement is $E = |a - 60|$ where a is the actual speed. For what values of a will E be 2.5 miles per hour?

$$2.5 = a - 60$$

$$62.5 = a$$

$$\text{OR } -2.5 = a - 60$$

$$\text{OR } 57.5 = a$$

Transformations of any graph: $y = a \cdot f(x - h) + k$ Name _____

a: Stretch or shrink **vertically** only (Multiply only the y-coordinate by the scale factor.)

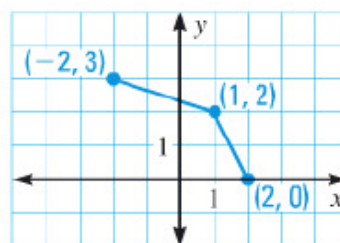
(If $a < 0$, then **reflect** the resulting graph in (over) the x-axis.) (Change the y-coordinate to its opposite.)

h: translate the points h units horizontally (Add h to the x-coordinate.)

(be careful.... $(x - 3)$ would be a movement to the right while $(x + 3)$ would be a movement to the left)

k: translate the points k units vertically (Add k to the y-coordinate.)

($+ 8$ would be a movement up and $- 8$ would be a movement down.)



$x - 4$ $h = 4$
 $x - h$ right 4

1. Use the graph of $f(x)$ above to find the coordinates of the new function:

$y = 3 \cdot f(x - 4) + 2$

$+4$ to x

$+k$
 $k = 2$
 $+2$ to y

(x, y)	Vertical Stretch or shrink? (Multiply y-coordinate only.)	Reflect? (Change y-coordinate only to its opposite)	Horizontal Shift? (Add h to the x-coordinate.)	Vertical Shift? (Add k to the y-coordinate.)
$(-2, 3)$	$(-2, 9)$	$(-2, 9)$	$(2, 9)$	$(2, 11)$
$(1, 2)$	$(1, 6)$	$(1, 6)$	$(5, 6)$	$(5, 8)$
$(2, 0)$	$(2, 0)$	$(2, 0)$	$(6, 0)$	$(6, 2)$

2. Use the graph of $f(x)$ above to find the coordinates of the new function:

$h = -1$
 $x \rightarrow -1$
 $y = -f(x + 1) - 4$
 -4 from y

(x, y)	Vertical Stretch or shrink? (Multiply y -coordinate only.)	Reflect? (Change y -coordinate only to its opposite)	Horizontal Shift? (Add h to the x -coordinate.)	Vertical Shift? (Add k to the y -coordinate.)
$(-2, 3)$	$(-2, 3)$	$(-2, -3)$	$(-3, -3)$	$(-3, -7)$
$(1, 2)$	$(1, 2)$	$(1, -2)$	$(0, -2)$	$(0, -6)$
$(2, 0)$	$(2, 0)$	$(2, 0)$	$(1, 0)$	$(1, -4)$