

NOTES: Section 2.7 – Use Absolute Value Functions and Transformations

Goals: #1 – I can solve an absolute value equation in order to find the x -intercepts of an absolute value graph.

#2 – I can graph absolute value equations and describe if the function is a stretch, shrink, reflection, and/or translation of the parent function.

#3 – I can graph the transformation of a function by identifying a stretch, shrink, reflection, and/or translation of the parent function, $f(x)$.

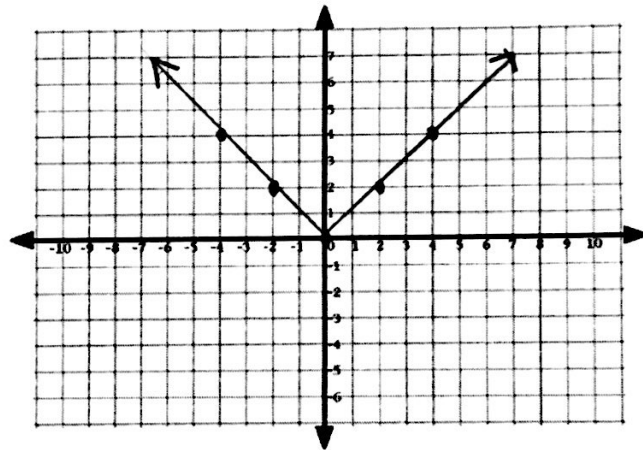


Homework: Lesson 2.7 Worksheet

Exploration #1: Fill in the table and graph the function.

1. $f(x) = |x|$

x	$f(x)$
-4	4
-2	2
0	0
2	2
4	4



2. Describe what happens to the *vertex* when Ms. Hentrich does the following:

a. $f(x) = |x| + 5$

Up 5

b. $f(x) = |x + 5|$

Left 5

c. $f(x) = |x + 5| + 5$

Left 5

Up 5

d. $f(x) = -|x|$

Reflect over x -axis

e. $f(x) = 5|x|$

shrinks

f. $f(x) = \frac{1}{5}|x|$

stretches

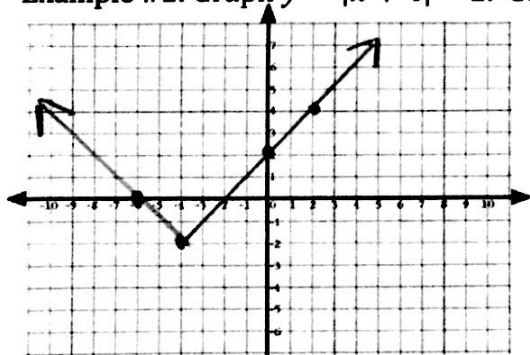
Transformation	$f(x)$ Notation	Examples
Vertical Translation (shift up and down)	Shift Up $f(x) + a$ Shift Down $f(x) - a$	$y = x + 5$ $y = x - 5$
Horizontal Translation (shift left and right)	Shift Left $f(x + a)$ Shift Right $f(x - a)$	$y = x + 5 $ $y = x - 5 $
Reflection (in the x-axis)	$-f(x)$	$y = - x $
Vertical Stretch/Shrink (narrower and wider)	$a > 1$ Narrower $a f(x)$ $0 < a < 1$ Wider $a f(x)$	$y = 5 x $ $y = \frac{1}{5} x $

Notes:

A transformation changes a graph's size, shape, position, or orientation.

A translation is a type of transformation that shifts a graph horizontally and/or vertically, but does NOT change its size, shape, or orientation.

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



x	-6	-4	0	2
y	0	-2	2	4

Vertex: $(-4, -2)$

Graph opens: up (no reflection)

Comparisons:

- translation down 2 units
- translation left 4 units

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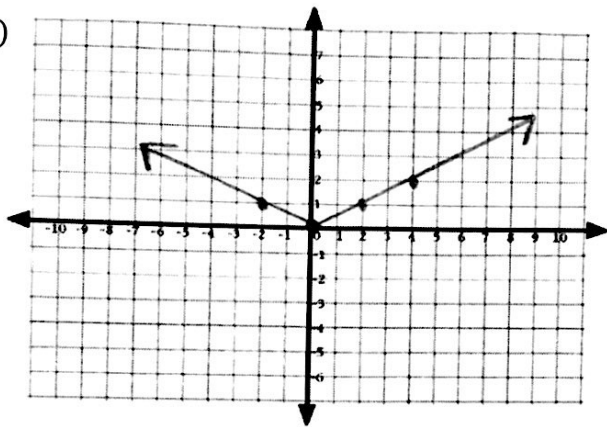
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Example #2: Graph (a) $y = \frac{1}{2}|x|$ and (b) $y = -3|x|$. Compare each graph with the graph of $y = |x|$.

↳ V
shrink

reflect
(x-axis)
↳ V
stretch

(a)



x	-2	0	2	4
y	1	0	1	2

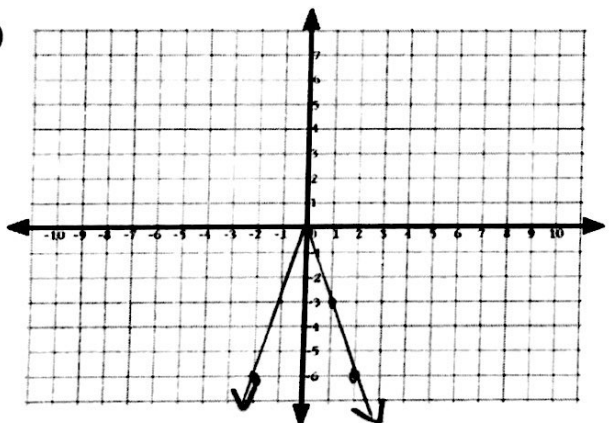
Vertex: (0,0)

Graph opens: up (no reflection)

Comparisons:

- vertical shrink by a factor of $\frac{1}{2}$

(b)



x	-2	0	1	2
y	-6	0	-3	-6

Vertex: (0,0)

Graph opens: down (reflection)

Comparisons:

- Reflection in the x-axis
- vertical stretch by a factor of 3

Notes:

The graph of $y = a|x-h| + k$ can involve a vertical stretch or shrink, a reflection, and a translation of the graph of $y = |x|$.

The vertex of $y = a|x-h| + k$ is (h, k) .

Example #3: Write an equation for the graph shown.

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

Vertex: (3, 2)

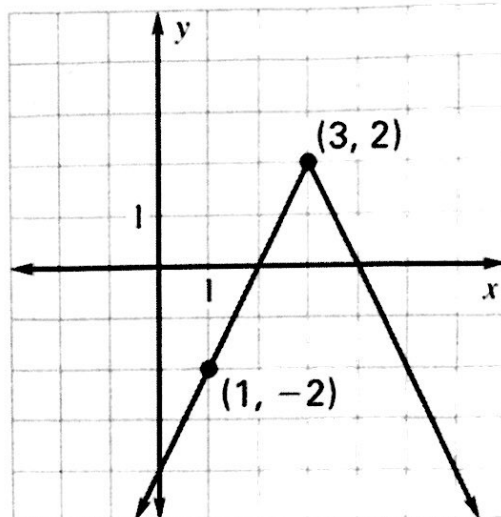
$$y = a|x - 3| + 2$$

Point: (1, -2)

$$-2 = a|1 - 3| + 2 \quad -4 = a|-2|$$

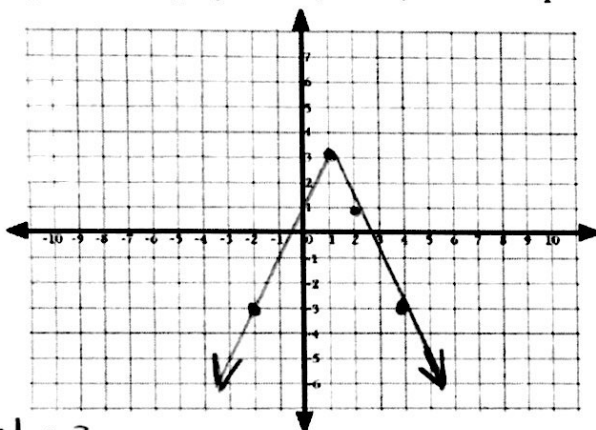
$$-2 = a|-2| + 2 \quad -4 = 2a$$

$$-2 \quad -2 \quad a = -2$$



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

Example #4: Graph $y = -2|x - 1| + 3$. Compare the graph with the graph of $y = |x|$.



Vertex: (1, 3)

Graph opens: Down (reflection)

Comparisons:

- Reflection in x-axis
- Vertical stretch by a factor of 2
- Translation right 1 unit
- Translation up 3 units

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

$$= -2|-3| + 3$$

$$= -2(3) + 3$$

$$= -6 + 3 = -3$$

x	-2	1	2	4
y	-3	3	1	-3

Example #5: Refer to the following function: $y = -\frac{7}{2}|x - 2| + 4$. Compare the graph of this

function to the graph of the function $y = |x|$. Make a bulleted list. Use terminology that we learned today.

- Reflection in the x-axis.
- Vertical stretch by a factor of $\frac{7}{2}$
- Translation right 2 units.
- Translation up 4 units.