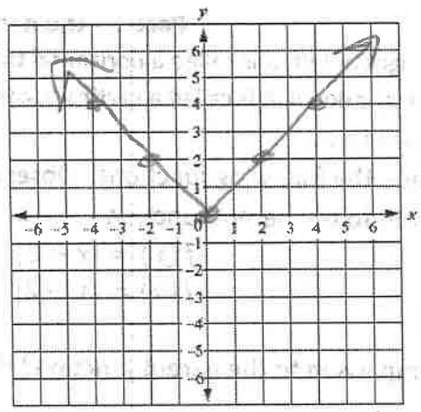
Graphing Absolute Value Functions

Name: Answer Key

Date: _____ Period: _____

**Part 1** - The function $f(x) = |x|$ is called the **parent absolute value function.** Fill out the table the left to graph the parent absolute value function.

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



Domain: R

Range: $\{y|y \geq 0\}$

x-intercept: (0,0)

y-intercept: (0,0)

The **vertex** is "corner" point on the graph.

Location of Vertex: (0,0)

Is it a function? yes

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- When a graph becomes narrower it is said to have a **vertical stretch.** (The distance from the line to the x-axis is getting larger, "stretching".)
- When a graph becomes wider it is said to have a **vertical shrink.** (The distance from the line to the x-axis is getting smaller, "shrinking".)

**Part 2 – the a value.**

Log on to www.geogebra.org/o/WumAjswC

This will open a Geogebra file to graph Absolute Value functions and see their transformations.

Click on "Show Slider Equation"

Adjust the slider for "a" to graph the following functions. Do not change the other values yet. Observe how each graph changes in comparison to the parent function.

$f(x) = 3|x|$ $f(x) = 0.5|x|$

$f(x) = 5|x|$ $f(x) = \frac{1}{4}|x|$

Does the vertex move in comparison to the parent function? If so, how far and which direction?

NO

Is this a vertical stretch or shrink in comparison to the parent function?

vertical stretch for $3|x|$ and $5|x|$ vertical shrink for $.5|x|$ and $\frac{1}{4}|x|$

Domain : R Range: $\{y|y \geq 0\}$

Location of Vertex: (0,0)

Create a rule using the vocabulary above:

$f(x) = a|x|$

| | |
|---|---|
| If $a > 1$ then.... | vertical stretch by factor of a |
| If $0 < a < 1$ then... | vertical shrink by factor of a |

**Part 2 continued – Negative a value**

Adjust the slider for "a" to graph the following functions. Do not change the other values yet.

$f(x) = -3|x|$ $f(x) = -0.5|x|$

$f(x) = -5|x|$ $f(x) = -\frac{1}{4}|x|$

Does the vertex move in comparison to the parent function? If so, how far and which direction?

NO

Is this a vertical stretch or shrink in comparison to the parent function?

NO

Domain : R Range: $\{y|y \leq 0\}$

Location of Vertex: (0,0)

Create a rule using the vocabulary above:

$f(x) = a|x|$

| | |
|---|---|
| If $a < 0$ then.... | reflection over x-axis |

Open your workbook to page 213 and 214. Answer those 8 questions **without** graphing using the vocabulary above.

**Part 3 – the h value**

- When a graph shifts right or left, it is called a **horizontal translation**.
- When a graph shifts up or down, it is called a **vertical translation**.

First Move the "a" value back to 1.

Adjust the "h" value to graph the following functions. Observe the direction and distance the graph moves for each new function compared to the parent function.

$f(x) = |x + 1|$ h=-1 $f(x) = |x - 3|$ h=3

$f(x) = |x + 4|$ h=-4 $f(x) = |x - 2|$ h=2

Did the vertex move in comparison to the parent function? How? If so where?

yes. if +h moved left if -h moved right

Domain: IR Range: {y|y ≥ 0}

Location of Vertex: (h, 0)

If $f(x) = |x - h|$ what is the value of $h$ in the function you graphed? *** notice the function is **minus** $h$***

See above

How does that relate to the vertex movement? since equation subtracts h, |x+h| moves left |x-h| moves right

Create a rule using the vocabulary above :

$f(x) = |x - h|$

| | |
|---|---|
| If $h > 0$ then.... | horizontal translation right h units |
| If $h < 0$ then... | horizontal translation left h units |

**Part 4 – the k value**

Move the h value back to 0.

Now adjust just the k value to graph the following functions. Observe the changes in the graph compared to the parent function.

$f(x) = |x| + 3$ k=3 $f(x) = |x| - 2$ k=-2

$f(x) = |x| + 5$ k=5 $f(x) = |x| - 4$ k=-4

Did the vertex move in comparison to the parent function? If so, where?

yes. moved up for +k, moved down for -k,

Domain: IR Range: _____

Location of vertex: (0, k)

If $f(x) = |x| + k$ what is the value of $k$ in the function you graphed? see above

How does that relate to the vertex movement? +k moves up, -k moves down

Create a rule using the vocabulary above:

$f(x) = |x| + k$

| | |
|---|---|
| If $k > 0$ then.... | vertical translation up k units |
| If $k < 0$ then... | vertical translation down k units |

**Part 5 – Putting the rules together.**

Graph each function on geogebra. Observe the movement of the graph compared to the parent function.

$f(x) = 2|x + 1|$ $f(x) = -x|x - 3| + 2$

- Open your book to page 251. Describe the change from the parent function **without** graphing. Use the vocabulary above.
- Complete the chart on the top of page 208 and the bottom of page 254.

Tell whether each statement is sometimes, always, or never true.

- An absolute value function has an x-intercept. sometimes.
- An absolute value function has two y-intercepts. never.
- The vertex of an absolute value function is on the x-axis. sometimes

Now complete page 257 # 4-19