Name ______________________________ Class ____________ Date ____________

2-7 Reteaching

Absolute Value Functions and Graphs

A function of the form $y = a|x - h| + k$ is an *absolute value function*. The graph of $y = a|x - h| + k$ is an angle; its vertex is located at the point (h, k).

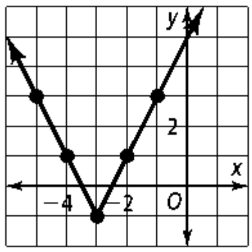
Problem

What is the graph of $y = 2|x + 3| - 1$?

This function is in the general form $y = a|x - h| + k$ where $a = 2$, $h = -3$, and $k = -1$. The vertex is (h, k) or $(-3, -1)$.

Now make a table showing several points on the graph. Choose values of x on both sides of the vertex.

x	–5	–4	–3	–2	–1
y	3	1	–1	1	3



Plot the vertex and the points from the table.

Connect the points to graph the function.

Exercises

Make a table of values for each equation. Then graph the equation.

1. $y = |3x|$

2. $y = |3x - 1|$

3. $y = \left|\frac{1}{2}x + 1\right|$

4. $y = |x - 1| + 3$

5. $y = 2|x + 1| - 5$

6. $y = -\frac{1}{2}|x - 1| + 4$

2-7 Reteaching (continued)

Absolute Value Functions and Graphs

The table below shows the transformations of the graph of the parent function $y = |x|$. A translation is a transformation that shifts a graph vertically or horizontally without changing the graph's shape, size, or orientation.

Vertical Translation of $y = \|x\|$	**Horizontal Translation of** $y = \|x\|$
$y = \|x\| + k$ If $k > 0$, translate UP k units. If $k < 0$, translate DOWN $\|k\|$ units.	$y = \|x - h\|$ If $h > 0$, translate to the RIGHT h units. If $h > 0$, translate to the LEFT $\|h\|$ units.
Vertical Stretch and Compression of $y = \|x\|$	**Reflection of** $y = \|x\|$
$y = a\|x\|, a > 0$ if $a > 1$, the graph is narrower. This is a vertical stretch of the parent graph. If $a < 1$, the graph is wider. This is a vertical compression of the parent graph.	$y = -\|x\|$ The graph of the parent function is reflected in the x-axis.

Problem

Compare $y = -3|x + 1| + 2$ with the parent function $f(x) = |x|$.. Without graphing, find the vertex, axis of symmetry, and transformations.

First find the vertex:

This function is in the general form $y = |x - h| + k$ where $a = -3$, $h = -1$, and $k = 2$. The vertex is $(-1, 2)$. The axis of symmetry is $x = -1$.

Describe the transformation of the parent function $f(x) = |x|$:

$k = 2$, so the graph is translated up 2 units.

$a = -3$, so the graph is reflected in the x-axis AND vertically stretched by a factor of 3.

$h = -1$, so the graph is translated to the left 1 unit.

Exercises

Without graphing, identify the vertex, axis of symmetry, and transformations from the parent function $f(x) = |x|$.

7. $y = |x - 1| + 2$

8. $y = 3|x|$

9. $y = 2|x + 1| - 3$

10. $y = -\frac{1}{2}|x|$

11. $y = \frac{3}{2}|x| + 2$

12. $y = 4|x - 5| + 3$

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2-8 Reteaching

Two-Variable Inequalities

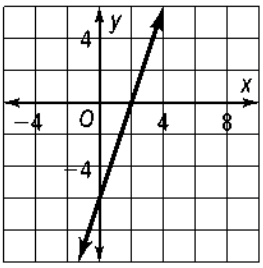
A **linear inequality** in two variables is an inequality whose graph is a region of the coordinate plane bounded by a line. This line is the **boundary**. If the boundary is included in the solution of the inequality, it is drawn as a solid line. If the boundary is not part of the solution of the inequality, it is drawn as a dashed line.

Problem

What is the graph of $6x - 2y \leq 12$?

$6x - 2y \leq 12$

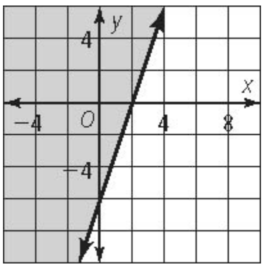
$y \geq 3x - 6$ — To graph the boundary line, write the inequality in slope-intercept form as if it were an equation.



The boundary line is solid if the inequality contains ≤ or ≥. The boundary line is dashed if the inequality contains, < or >. Graph the boundary line y = 3x – 6 as a solid line.

$0 \geq 3(0) - 6$ — Since the boundary line does not contain the origin, substitute the point (0, 0) into the inequality.

$0 \geq -6$ — Simplify. The resulting inequality is true.



Shade the region that contains the origin. If the resulting inequality were false, then you would shade the region that does not contain the origin.

Exercises

Graph each inequality.

1. $y > 2x$ **2.** $x + y < 4$ **3.** $y < x + 1$

4. $3x - 2 \leq 5x + y$ **5.** $x < -4$ **6.** $y \geq 5$

2-8 Reteaching (continued)

Two-Variable Inequalities

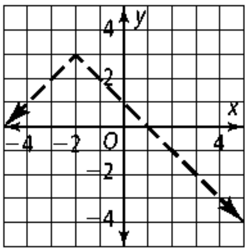
To graph two-variable absolute value inequalities, graph the boundary line. Then pick a test point and shade appropriately.

Problem

What is the graph of $3 - y < |x + 2|$?

$3 - y < |x + 2|$ To graph the boundary line, write the inequality in terms of *y* as if it were an equation. The boundary line is dashed because the inequality contains >.

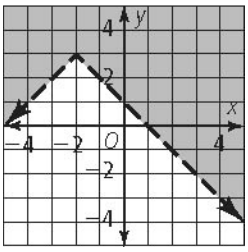
$y. > -|x + 2| + 3$



Graph the boundary line $y = -|x + 2| + 3$.

$0 \geq -|0 + 2| + 3$ Now pick a test point. Because the boundary line does not contain the origin, substitute the point (0, 0) into the inequality.

$0 \not\geq 1$ Simplify. The resulting inequality is untrue.



Shade the region that *does not* contain the origin. If the resulting inequality were true, then you would shade the region that *does* contain the origin.

Exercises

Graph each absolute value inequality.

7. $y \leq |4x|$ **8.** $y > |-3x|$ **9.** $y \geq -|2x|$

10. $y < |x + 2| - 4$ **11.** $y \leq \frac{3}{2}|x| - \frac{5}{2}$ **12.** $-3y > |3x - 6|$