Lesson 1.6: Absolute Value Equations and Inequalities

$|x-25| = 17$

$|2x + 4| + 1 \geq 13$

Lesson 1.6: Absolute Value Equations and Inequalities

What is an Absolute Value?

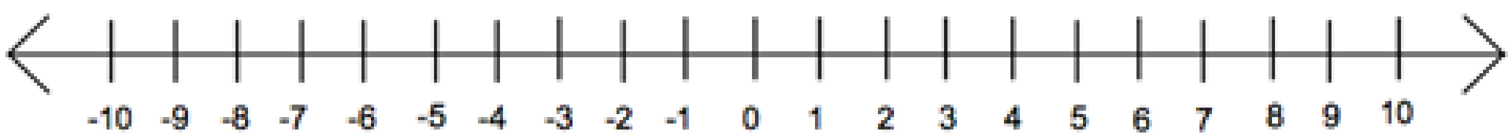
1. $|3| =$

2. $|-10| =$

3. $|-2| =$

Why do we make them positive?

The **Absolute Value** is the distance from Zero on the number line.



Lesson 1.6: Absolute Value Equations and Inequalities

Example 1:

Evaluate $|3x-6| + 3.2$ if $x = -2$

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Example 2 part A:

- For what values of x would this equation be true? $|x| = 3$

- For what values of x would this equation be true? $|x+2| = 5$

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Example 2 part B: The Evil Twin -*the negative side*

Solve $|x-25| = 17$

This means that we could be on the positive side and have

$$(x-25) = 17$$

or we could be on the negative side and have

$$-(x-25) = 17$$

We can take $-(x-25) = 17$ and divide by a negative on both sides. Then we would have

$$(x-25) = -17$$

"Okay, one time, but just remember who the evil twin in this family really is."

Example 2: The Evil Twin *-the negative side*

Solve $|x-25| = 17$

So we have two options our equation could be:

$(x-25) = 17$ **or** $(x-25) = -17$

Example 2: The Evil Twin *-the negative side*

Solve $|x-25| = 17$

So we have two options our equation could be:

$(x-25) = 17$ or $(x-25) = -17$

$+25 \quad +25$	$+25 \quad +25$
$x = 42$	$x = 8$

Now write in set notation:

$\{42, 8\}$

Example 3:

Solve $|x+6| = 18$

So we have two options our equation could be:

$x+6 = 18$ **or** $x + 6 = -18$

Example 4:

Solve $3|x + 6| = 36$

Note: we must ALWAYS get the absolute value alone before we do the evil twin.

So we have two options our equation could be:

$(x + 6) = 12$ **or** $(x+6) = -12$

Example 6:

Solve $|2x + 7| - 5 = 0$

Example 6.1:

Solve $|2x + 7| + 5 = 0$

What happens if an absolute value is supposedly equals a negative number? Can that happen?

Example 7:

Solve $|x - 2| = 2x - 10$

So we have two options our equation could be:

$x - 2 = 2x - 10$ **or** $x - 2 = -(2x - 10)$

$x - 2 = -2x + 10$

Example 8:

Solve $|2x - 3| = |x + 6|$

Note: We treat this just like a regular Abs. Value equation. We let $2x-3 = x+6$ AND $2x-3 = -(x+6)$. (refer to pg 115)

So we have two options our equation could be:

$2x-3 = x+6$ **or** $2x-3 = -(x+6)$

$2x-3 = -x - 6$

Example 9:

You MUST get the absolute value alone first before you do "evil twins"!!!

Solve $-2\,|2x-7| - 1 = -35$

Lesson 1.6: Absolute Value Equations and Inequalities

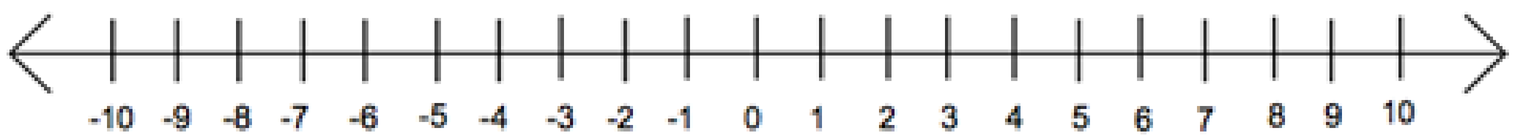
Now we are going to look at Absolute Value Inequalities ($<$, $>$, $\leq$, $\geq$).

We will treat them the same way, except we need to remember to *flip the inequality sign when we divide by a negative (the evil twin).*

We will also graph our solution set and write in interval notation.

Lesson 1.6: Absolute Value Equations and Inequalities

Example 10: $|2x + 4| + 1 \geq 13$



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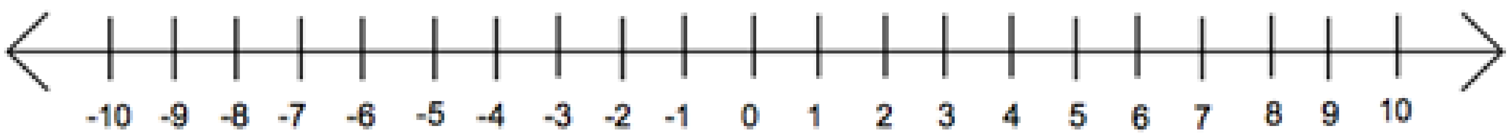
Example 11: $|2x - 9| \leq 27$



STOP AND THINK!!!

Just like with Absolute values, we have some special cases (remember that absolute values can't equal a negative?).

Special Case #1:

An absolute value that is $<$ or $\leq$ a negative number will never have a solution.

This is because an abs. val. is the distance from zero. Distance can never be less than zero (a negative).

Example: $|2x + 6| < -12$

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Solve and graph.

Ex: $|x - 4| + 6 \leq 1$

Special Case #2:

An absolute value that is > or $\geq$ a negative number will have a solution of all real numbers.

This is because an abs. val. is the distance from zero. Distance will always be greater than zero (a negative).

Example: $|x + 2| > -4$

Lesson 1.6: Absolute Value Equations and Inequalities

Solve and graph.

Ex: $|5x - 2| + 15 \geq 10$

Homework:

Pg 122: #'s 55-74 all, 81, 82

- For Equations, give answers in set notation.
- For Inequalities, give answers in set notation, interval notation, and graph.