Lesson #4: Section 1.5

By the end of the lesson you will be able to solve ***absolute value equations*** by:

~ Using the original non-absolute value equation &
~ Using the "evil twin" equation

$|-3| = 3$

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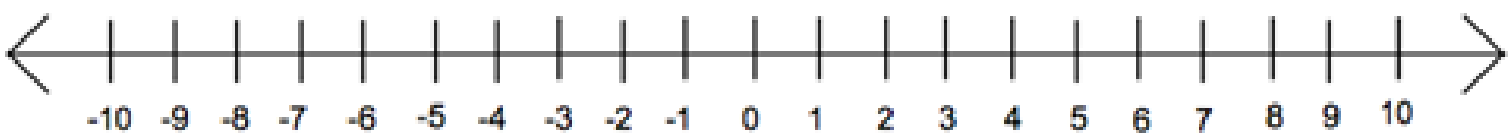
What is an Absolute Value?

1. $|3| =$ 3
2. $|-10| =$ 10
3. $|-2| =$ 2

Why do we make them positive?

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



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Example 1:

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

$= |3(-2)-6| + 3.2$

$= |-6-6| + 3.2$

$= |-12| + 3.2$

$= 12 + 3.2$

$= \boxed{15.2}$

Example 2: 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 $(x-25) = -17$

$+25 \quad +25$	$+25 \quad +25$
$x = 42$	$x = 8$
$\lvert 42-25 \rvert \stackrel{?}{=} 17$	$\lvert 8-25 \rvert \stackrel{?}{=} 17$
$\lvert 17 \rvert \stackrel{?}{=} 17$	$\lvert -17 \rvert \stackrel{?}{=} 17$
$17 = 17$ ✓	$17 = 17$ ✓

$$\begin{array}{r} 25 \\ -17 \\ \hline 8 \end{array}$$

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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 $(x-25) = -17$

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

Example 3:

Solve $|x+6| = 18$

So we have two options our equation could be:

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

$$-6 \quad -6 \qquad\qquad -6 \quad -6$$

$$x = 12 \qquad\qquad x = -24$$

$$|12+6| \stackrel{?}{=} 18 \qquad\qquad |-24+6| \stackrel{?}{=} 18$$

$$|18| \stackrel{?}{=} 18 \qquad\qquad |-18| \stackrel{?}{=} 18$$

$$18 = 18 \checkmark \qquad\qquad 18 = 18 \checkmark$$

* You must get the abs. Val. alone BEFORE you do evil thins

Example 4:

Solve $3|x + 6| = 36$

$\frac{3|x+6|}{3} = \frac{36}{3}$

$|x+6| = 12$

So we have two options our equation could be:

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

$-6 \quad -6 \qquad\qquad -6 \quad -6$

$x = 6 \qquad\qquad x = -18$

$3|6+6| \stackrel{?}{=} 36 \qquad\qquad 3|-18+6| \stackrel{?}{=} 36$

$3|12| \stackrel{?}{=} 36 \qquad\qquad 3|-12| \stackrel{?}{=} 36$

$3(12) \stackrel{?}{=} 36 \qquad\qquad 3(12) \stackrel{?}{=} 36$

$36 = 36$ ✓ $\qquad\qquad 36 = 36$ ✓

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Example 5: Story Problems

Hypothermia and Hyperthermia are similar words but have opposite meanings. **Hyper**thermia means an extremely high body temperature and **Hypo**thermia means an extremely low body temperature. Both can be dangerous. If the body temperature is 8 degrees above OR below, we have problems. The normal body temperature is 98.6 degrees.

At what temperatures do these conditions begin to occur? 90.6 & 106.6

Let b =body temperature (not the normal). Solve using Absolute Values.

$$|b-98.6| = 8$$

$$b-98.6=8 \qquad b-98.6=-8$$

Example 6:

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

$$+5 \quad +5$$

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

$$2x+7=5 \qquad 2x+7=-5$$

$$-7 \;\; -7 \qquad -7 \;\; -7$$

$$\frac{2x}{2} = \frac{-2}{2} \qquad \frac{2x}{2} = \frac{-12}{2}$$

$$\boxed{x=-1} \qquad \boxed{x=-6}$$

Check $x=-1$

$$|2(-1)+7|-5 \stackrel{?}{=} 0$$

$$|-2+7|-5 \stackrel{?}{=} 0$$

$$|5|-5 \stackrel{?}{=} 0$$

$$5-5 \stackrel{?}{=} 0$$

$$0=0 \checkmark$$

$x=-6$

$$|2(-6)+7|-5 \stackrel{?}{=} 0$$

$$|-12+7|-5 \stackrel{?}{=} 0$$

$$|-5|-5 \stackrel{?}{=} 0$$

$$5-5 \stackrel{?}{=} 0$$

$$0=0 \checkmark$$

Example 6.1:

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

$$-5 \quad -5$$

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

$\varnothing$

no Solution

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

$x - 2 = -2x + 10$

$$x - 2 = 2x - 10$$
$$-x \quad -x$$
$$-2 = x - 10$$
$$+10 \quad +10$$
$$\boxed{8 = x}$$

$$x - 2 = -2x + 10$$
$$-x \quad -x$$
$$-2 = -3x + 10$$
$$-10 \quad -10$$
$$-12 = -3x$$
$$\frac{-12}{-3} = \frac{-3x}{-3}$$
$$\boxed{4 = x}$$

Checked and didn't work

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

Check $x=8$	Check $x=4$
$\lvert 8-2\rvert \stackrel{?}{=} 2(8)-10$	$\lvert 4-2\rvert \stackrel{?}{=} 2(4)-10$
$\lvert 6\rvert \stackrel{?}{=} 16-10$	$\lvert 2\rvert \stackrel{?}{=} 8-10$
$6 \stackrel{?}{=} 6$	$2 \stackrel{?}{=} 8-10$
$6 = 6$ ✓	$2 \neq -2$
	✗

Journal #4:

Due ~~beginning of next class.~~ end of Math Lab

Assignment #4:

Due at the ~~end~~ Beg of next class ~~period~~ B1.