Name_____

Algebra 2
Lesson 1-5
Absolute Value Equations and Inequalities

When you travel to school you travel a certain distance, like 5.2 miles. The distance from school to home would then be 5.2 miles as well, NOT -5.2 miles. Distance is an **absolute value**. In equations **absolute value** of a number is its distance from zero on the number line and uses the symbol $|\ |$. ***Remember absolute value is nonnegative!***

Therefore, if $x \geq 0\ (positive), then\ |x| = x$ and $|-x| = x$.

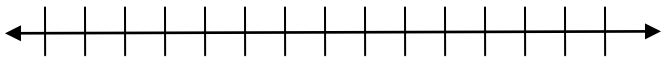
For example: $|$-16$|$=16, $|53| = 53$

To solve equations with absolute values remember the following steps and rules.

1. Absolute value equations will have two (2) solutions.
2. To solve and absolute value equation **first** isolate the absolute value expression on the left side of the equation.
3. Break down the equation into 2 separate equations using an **or** between them.
4. The right sides of the equations will opposites.
5. ***Caution*** may solve and get an **extraneous** solution which is not really a solution! Extraneous solutions are found when checking the answers. So, CHECK YOUR WORK!!
6. Absolute value equations may not have a solution; ***remember*** absolute values cannot be equal to a negative value.
7. **Absolute value inequalities** are handled similarly equalities. The right sides of the equations will be opposites **with** the inequality symbol will be opposite too.

Therefore, if *k* is a positive real number: $|x| \geq k, then\ x \leq k\ \ or\ x \geq k$.
$|x| \leq k, then -k \leq x \leq k$.

Examples: $|3x + 6| \geq 12$
$3x + 6 \geq 12 \quad or \quad 3x + 6 \leq -12$



$2|3x - 1| = 8$

$\frac{1}{4}|3t - 2| - 10 = 15$

$|2x + 5| = 3x + 4$

$|4w + 9| = -7$

Name_____

Algebra 2
Problem Set 1-5
Absolute Value Equations and Inequalities

1. Solve.
a) $|2x - 5| = 9$

b) $|1 - 3t| = 20$

c) $|5y - 8| = -1$

2. Solve.
a) $|10x - 3| = 0$

b) $|5x + 9| = -3$

3. Solve
a) $|x - 2| = 3x + 1$

b) $|4x + 3|$=3-x

c) $|2x - 1| = x + 3$

4. Solve, show answer in interval notation.
a) $|2x - 4| < 10$

b) $|9m + 2| \leq 1$

c) $|3 - 2z| \leq 5$

d) $|2x - 3| > 7$

e) $|6t + 10| \geq 3$

5. The inequality, $|T - 49| \leq 20$, describes the range of monthly average temperatures T in degrees Fahrenheit for Santa Fe, NM. What is the range of temperatures?

6. Products are often manufactured to b a given size to within a specified tolerance. For instance, if an aluminum can is supposed to have a diameter of 3 inches, either 2.99 or 3.01 inches might be acceptable. If the maximum error in the diameter *d* of a certain can is limited to 0.004 inch, then *d* must satisfy the absolute value inequality

$$|d - 3| \leq 0.004$$

Solve this inequality and interpret the results.

7. A metal part for a machine is now 5.85 inches long. The specifications call for it to be 5.72 inches long, with a tolerance of ±0.02 inch. By how much can a machinist decrease the length of the part?