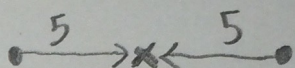# Absolute Value Equations

Absolute Value is __the magnitude of a number without regard to its__
__sign__ or __DISTANCE from 0__

| | is the symbol used for absolute value.

Steps to solve equations containing absolute value:

1. __Isolate__ the absolute value expression.

2. Set the quantity __inside__ the absolute value to __+ & −__ of the quantity on the other side of the equation. (This is because the distance can be measured from both __directions__.)

$$\overset{5}{\bullet\longrightarrow}x\overset{5}{\longleftarrow\bullet}$$

3. __Solve__ for the unknown in both equations.

4. __CHECK__ your answers to __verify__ they are actual solutions.

Examples: Solve for x.

1. $|x - 10| = 6$
$$x - 10 = \pm 6$$
$$+10 \quad +10$$
$$x = 10 \pm 6$$
$$\boxed{x = 16, 4}$$

Check:
$$|16-10| \overset{?}{=} 6$$
$$|6| = 6 \checkmark$$
$$|4-10| \overset{?}{=} 6$$
$$|-6| = 6 \checkmark$$

2. $|5 - 2x| - 6 = 7$
$$\qquad +6 \quad +6$$
$$|5 - 2x| = 13$$
$$5 - 2x = \pm 13$$
$$-5 \qquad -5$$
$$\frac{-2x = -5 \pm 13}{-2 \qquad -2}$$
$$\boxed{x = -4, 9}$$

Check:
$$|5-2(-4)|-6 \overset{?}{=} 7$$
$$|5+8|-6 = 7$$
$$|13|-6 = 7$$
$$13-6 = 7 \checkmark$$
$$|5-2(9)|-6 = 7$$
$$|5-18|-6 = 7$$
$$|13|-6 = 7 \quad 13-6=7 \checkmark$$

3. $|4x + 6| + 8 = 3$
$$\qquad -8 \quad -8$$
$$|4x + 6| = -5$$

NO SOLUTION

(distance cannot be Negative!)

4. $|3x + 2| = 4x + 5$
$$3x+2 = 4x+5 \qquad 3x+2 = -(4x+5)$$
$$-3x \quad\; -3x \qquad\quad 3x+2 = -4x-5$$
$$2 = x+5 \qquad\qquad +4x \qquad +4x$$
$$-5 \quad -5 \qquad\qquad 7x+2 = -5$$
$$x = -3 \qquad\qquad\quad -2 \quad\; -2$$
$$\qquad\qquad\qquad\qquad\quad \frac{7x = -7}{7}$$
$$\qquad\qquad\qquad\qquad\quad \boxed{x = -1}$$

Check:
$$|3(-3)+2| \overset{?}{=} 4(-3)+5$$
$$|-9+2| = -12+5$$
$$|-7| \neq -7$$
"EXTRANEOUS SOLUTION"

Check:
$$|3(-1)+2| \overset{?}{=} 4(-1)+5$$
$$|-3+2| = -4+5$$
$$|-1| = 1 \checkmark$$

***Remember: Absolute value is always __positive (or 0)__. An equation such as

$$|x - 10| = -50$$

is __NEVER__ true. It has __NO SOLUTION__ or $x = \emptyset$
(empty set")