**P.6 SOLVING INEQUALITIES ALGEBRAICALLY AND GRAPHICALLY**

Learning Targets for P.6
1. Solve Absolute Value Inequalities using correct notation and vocabulary
2. Solve quadratic or cubic inequalities by finding zeros on a graph
3. Apply solving inequalities to context including but not limited to projectile motion

Solving inequalities will be much like solving equations. However, when absolute values are involved, there are a few definitions and rules you must remember.

*Definition of Absolute Value*

If $x$ is any real number, then the absolute value of $x$, denoted $|x|$ is defined as

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

Absolute Value is best viewed as a distance. When finding the absolute value of a single number, you are finding the

_____ that number is from _____.

*Example 1*: Write an absolute value equation that expresses the following statement:
"The distance between $x$ and the number 4 is 7"

*Example 2*: Consider the equation $|2x+5| = 9$.

a) Solve the equation algebraically.

b) Solve the equation graphically. Describe your method.

c) If we factor out a 2 from the left side of the expression we get $2\left|x+\frac{5}{2}\right| = 9$. We can then divide both sides by 2 to obtain $\left|x+\frac{5}{2}\right| = \frac{9}{2}$. Using the concept of absolute value as a distance, draw the solution to this equation on a number line.

*Rules to Remember When Solving Absolute Value Inequalities*

Let $u$ be an algebraic expression in $x$ and let $a$ be a real number greater than 0.

1. $|u| < a$ if and only if $-a < u < a$
2. $|u| > a$ if and only if $u < -a$ or $u > a$

Informally, what these means is if you are represented by 🧍, then $|🧍|$ represents your distance from zero.

*Example 3*: If $|🧍| > 5$, use a number line to represent where YOU are allowed to be.

*Example 4*: If $|🧍| < 5$, use a number line to represent where YOU are allowed to be.

*Example 5*: Solve each inequality algebraically. Write your solution in interval notation.

a) $|2x-1| > 35$

b) $|3-4x| + 2 \le 9$

*Solving Inequalities Without Absolute Values … USING SIGN CHARTS!!!!!*

We will spend much more time with this later on in the year, but for now, a quick introduction.

*Example 6*: Solve $x^2 + x - 6 < 0$

a) Graphically

b) Algebraically using the ZEROS and a SIGN CHART

*Example 7*: The height , *h*, in feet of a projectile *t* seconds after is has been launched vertically from an initial height of $h_0$ feet above the ground with an initial velocity of $v_0$ feet/second is given by the formula

$h = -16t^2 + v_0 t + h_0$

a) If an object is launched with an initial velocity of 256 ft/sec from the ground, write the equation modeling the height of the object.

b) When does the object hit the ground?

c) When does the object reach it's maximum height?

d) What is the maximum height of the object?

e) When will this object be at least 768 feet above the ground?