



NOTES: SECONDARY 2 HONORS  
UNIT 6 – POLYNOMIAL INEQUALITIES

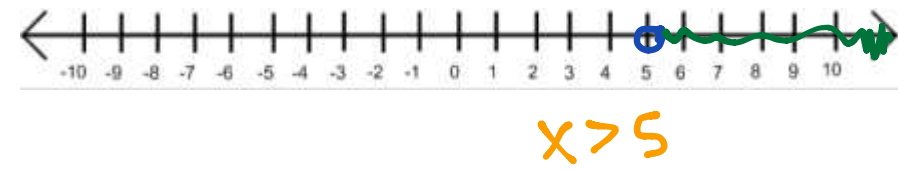
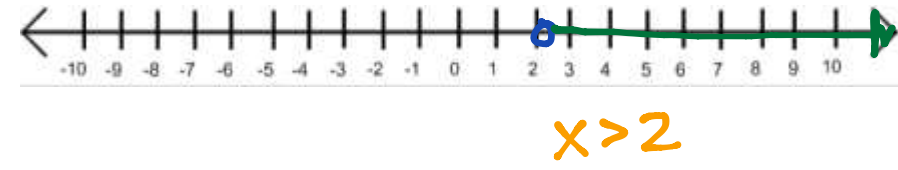
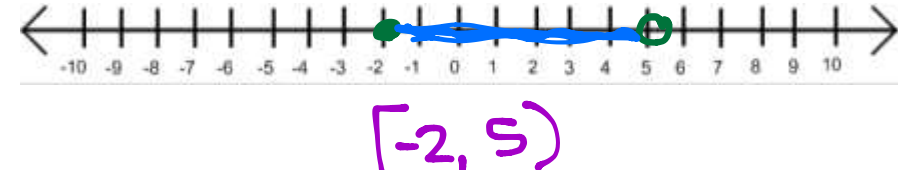
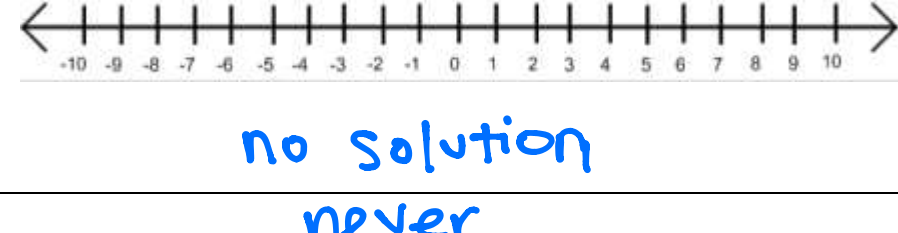
STARTER

<p>1. Factor</p> $f(x) = 9(x+3)^2 - 121$ $u = x+3$ $9u^2 - 121$ $(3u-11)(3u+11)$ <div style="border: 1px solid orange; padding: 2px; display: inline-block; margin: 5px;"> <math display="block">(3(x+3)-11)(3(x+3)+11)</math> </div> $(3x-2)(3x+20)$	<p>2. Solve for x. Graph your solution on a number line.</p> $4 \leq x+2 \leq 8$ $\begin{matrix} -2 & -2 & -2 \\ \hline 2 \leq x \leq 6 \end{matrix}$ 	<p>3. Solve for x. Graph your solution on a number line.</p> $8-t < 7 \text{ or } 8-t > 2$ $\begin{matrix} -8 & -8 & -8 & -8 \\ \hline -t < -1 & & -t > -6 \\ \hline t > 1 & & t < 6 \end{matrix}$ 
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Vocabulary:

- Compound Inequalities:** Two inequalities that are combined into one statement by the word and or or. The word and implies that values must satisfy each statement. The word or implies that values may satisfy either statement.

We did two examples of “normal” cases in the starter (#2 and #3). Now let’s look at some special cases.

$x > 2 \text{ and } x > 5$	
$x > 2 \text{ or } x > 5$	
$x \geq -2 \text{ and } x < 5$	
$x < 3 \text{ and } x > 5$	

# POLYNOMIAL INEQUALITIES

**STEP 1:** Set the polynomial equal to zero and solve.

There are five methods used to solve a quadratic. They are:

1. **factoring**
2. **quadratic formula**
3. **complete the square**
4. **graphing**
5. **take the square root**

Note: It does not matter which of the five methods you use. Sometimes some will be either than others.

**STEP 2:** Draw a number line (representing the x-axis) and mark your zeros. **RECALL:** the zeros are the x-intercepts on the graph.

**STEP 3:** Complete the sign graph for the function. Determine if the expression is positive or negative around each zero. Select a value in the interval and *evaluate* the expression at that value. Then, decide if the result is positive or negative.

**STEP 4:** Determine your answer and write your solution in interval notation.

**STEP 5:** Check your answer with the graph of the quadratic.

Example:

1. Solve  $x^2 - 2x - 3 > 0$ .

$$x^2 - 2x - 3 = 0$$

$$(x-3)(x+1) = 0$$

$$x = 3 \quad x = -1$$

Am I looking for "positive" or "negative"?



$$(-\infty, -1) \cup (3, \infty)$$

$x = -2$	$x = 0$	$x = 5$
$(-2-3)(-2+1)$	$(-)(+)$	$(+)(+)$
$(-)(-) = +$	$= -$	$= +$

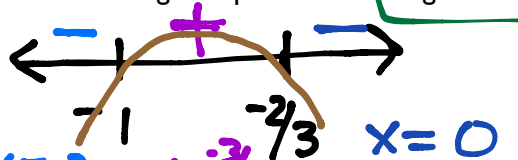
2. Solve  $-3x^2 - 5x - 2 \leq 0$ .

$$-(3x^2 + 5x + 2) \leq 0$$

$$(3x+2)(x+1) = 0$$

$$x = -1 \quad x = -\frac{2}{3}$$

Am I looking for "positive" or "negative"?



$$(-\infty, -1] \cup [-\frac{2}{3}, \infty)$$

$x = -2$	$x = -\frac{3}{4}$	$x = 0$
$-(-)(-)$	$-(-)(+)$	$-(+)(+)$
$= -$	$= +$	$= -$

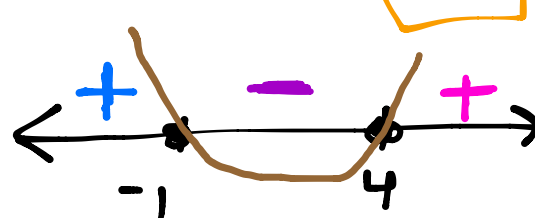
3. Solve  $x^2 - 3x \leq 4$ .

$$x^2 - 3x - 4 \leq 0$$

$$(x-4)(x+1) = 0$$

$$x = 4 \quad x = -1$$

Am I looking for "positive" or "negative"?



$$[-1, 4]$$

$x = -2$	$x = 0$	$x = 5$
$(-)(-)$	$(-)(+)$	$(+)(+)$
$= +$	$= -$	$= +$

Example:

A rocket is launched with an initial velocity of 160 ft. /sec from a 4 foot high platform. How long is the rocket at least 260 feet? (Use  $h(t) = -16t^2 + v_0t + h_0$ )

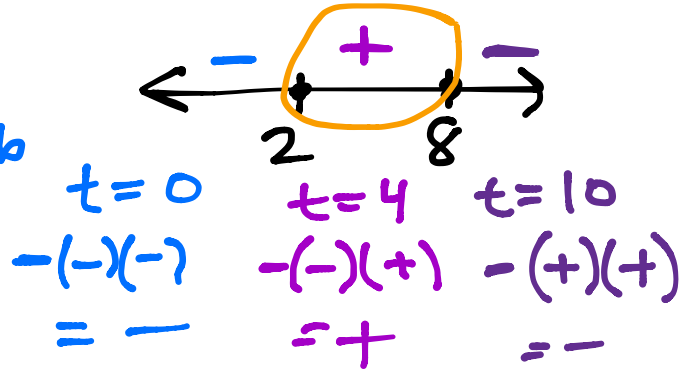
$$260 \leq -16t^2 + 160t + 4$$

$$0 \leq -16t^2 + 160t - 256$$

$$0 \leq -16(t^2 - 10t + 16)$$

$$0 \leq -16(t-8)(t-2)$$

$$t=2 \quad t=8$$



**RATIONAL INEQUALITIES**

You can solve rational inequalities the same way, except we also have to consider where the function is undefined as well as the zeros.

1. How do you find where a rational function is undefined?

The denominator is zero.

2. How do you find the zeros of a rational function?

The numerator is zero.

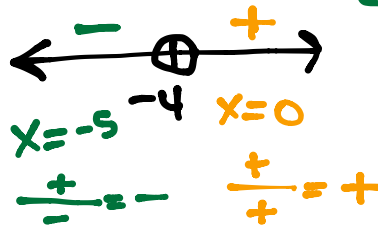
Example:

1. Solve  $\frac{2}{x+4} \leq 0$ .

Undefined:  
 $x+4=0$   
 $x=-4$

Zeros:  
 $2=0$

Am I looking for "positive" or "negative"?



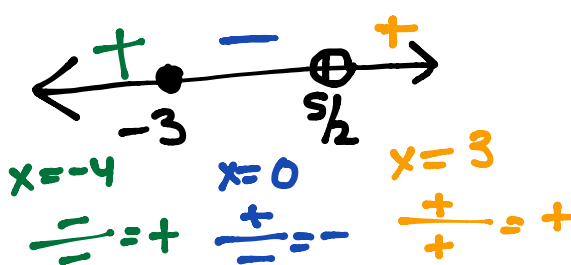
$(-\infty, -4)$

2. Solve  $\frac{x+3}{2x-5} \geq 0$ .

Undefined:  
 $2x-5=0$   
 $x=5/2$

Zeros:  
 $x+3=0$   
 $x=-3$

Am I looking for "positive" or "negative"?



$(-\infty, -3] \cup (\frac{5}{2}, \infty)$