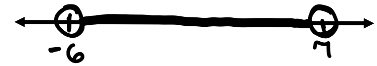
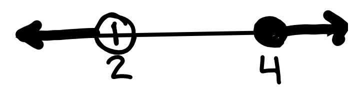
Solving Polynomial Inequalities

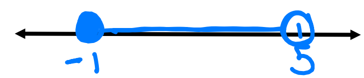
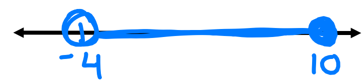
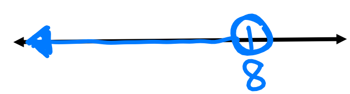
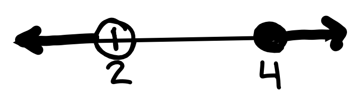
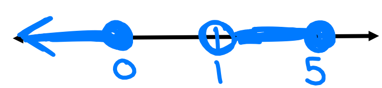
LINEAR

Day 1

Warm Up: Complete the chart below:

Set Notation	Interval Notation	Graphical
$\{x \mid -6 < x < 7, x \in \mathbb{R}\}$	$x \in (-6, 7)$	
$\{x \mid -1 \leq x < 5, x \in \mathbb{R}\}$		
	$x \in (4, 10]$	
		
$\{x \mid x < 8, x \in \mathbb{R}\}$		
		
	$x \in (-\infty, 0] \cup (1, 5]$	

Warm Up: Complete the chart below:

Set Notation	Interval Notation	Graphical
$\{x \mid -6<x<7, x\in\mathbb{R}\}$	$x\in(-6,7)$	
$\{x \mid -1\le x<5, x\in\mathbb{R}\}$	$x\in[-1,5)$	
$\{x\in\mathbb{R} \mid -4<x\le 10\}$	$x\in(4,10]$	
$\{x\in\mathbb{R} \mid x\ge -3\}$	$x\in[-3,\infty)$	
$\{x \mid x<8, x\in\mathbb{R}\}$	$x\in(-\infty,8)$	
$\{x\in\mathbb{R} \mid 2<x\le 4\}$	$x\in(2,4]$	
$\{x\in\mathbb{R} \mid x\le 0, 1<x\le 5\}$	$x\in(-\infty,0]\cup(1,5]$	

Recall: Interval notation describes two values that the variable must be **between**!

NOTE: it can only be used to represent **REAL NUMBERS**

(: exclude that value

[: include that value

Since $+/-\infty$ don't really exist, we can't "include" them. From $+\infty$ or $-\infty$ we use ( ).

How can we "solve" Inequalities?

Solving Inequalities

You can solve Inequalities ALMOST exactly the same as you can solv EQUALITIES.

Ex1: Solve $3a-2 \overset{\text{EQUALITY}}{=} 7$

$$3a = 9$$

$$\boxed{a = 3}$$

Ex2: Solve $3a-2 \overset{\text{Inequality}}{>} 7$

$$3a > 9$$

$$\boxed{\begin{array}{c} a > 3 \\ a \in (3, \infty) \end{array}}$$

SAME AS Solving Inequalities:

REARRANGE so the variable is on one side of the inequality & the constant is on the other.

Solve $-x < 4$

$$0 < 4 + x$$

$$-4 < x \rightarrow \boxed{x > -4} \quad x \in (-4, \infty)$$

The But! and its a big but!

__BUT__ you must consider/be cautious of negatives.

Consider $1 < 3$ which is a true statement

$+2 \quad +2$

$3 < 5$

$\cdot 2 \quad \cdot 2$

$6 < 10$

the statement remains true using most math operations

$1 < 3$ __but__ multiply or divide both sides by 1.

$\cdot -1 \quad \cdot -1$

greater

✗ $-1 < -3$ ← NOT true! -1 is __More__ than -3.

negative flips it

✓ __but__ $-1 > -3$ is correct! the sign flipped!

☆ Any time you need to multiply or divide by a negative number, you __MUST__ reverse the inequality symbol.

Examples:

Ans:

a.) $-2x+4>5$ $\longrightarrow$ $x\in(-\infty,-\frac{1}{2})$

b.) $5<2x+1\leq 8$ $\longrightarrow$ $x\in(2,\frac{7}{2})$

c.) $2\leq -2x+1<4$ $\longrightarrow$ $x\in(-\frac{3}{2},-\frac{1}{2}]$

d.) $2x-4<3x+2\leq x-6$ $\longrightarrow$ $x\in(-6,-4]$

e.) $\underbrace{-x+4>x+2\geq -2x-1}$ $\longrightarrow$ $x\in[-1,1)$

Solve as 2 seperate inequalities

Don't forget to check your answer using an appropriate value for x. (within the inequality domain) c.) $2 \le -2x+1 < 4$

$\quad -1 \qquad -1 \qquad -1$

$\frac{1}{-2} \le \frac{-2x}{-2} < \frac{3}{-2}$

$-\frac{1}{2} \ge x > -\frac{3}{2}$

$x \in \left(-\frac{3}{2}, -\frac{1}{2}\right]$

d.) $\underbrace{2x-4 < 3x+2} \le x-6$; $2x-4 < \underbrace{3x+2 \le x-6}$

$2x-4 < 3x+2$

$-2x \; -2 \qquad -2x \; -2$

$-6 < x$

$3x+2 \le x-6$

$-x \; -2 \qquad -x \; -2$

$2x \le -8$

$x \le -4$

$-6 < x \le -4$

$x \; (-6, -4]$

e.) $\underbrace{-x+4 > x+2} \ge -2x-1$; $-x+4 > \underbrace{x+2 \ge -2x-1}$

$-x+4 > x+2$

$+x \; -2 \qquad +x \; -2$

$2 > 2x$

$1 > x$

$x+2 \ge -2x-1$

$+2x \; -2 \qquad +2x \; -2$

$3x \ge -3$

$x \ge -1$

$-1 \le x < 1$

$x \in [-1, 1)$

For complex Inequalities with a variable in multiple places you ~~can~~ have to solve the inequality by splitting it up