Lesson 3 : Solving Linear Inequalities

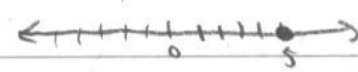
- what is a linear inequality?
  - we learned that linear means variable is to the 1^{st} power
  - inequality ⇒ not equals
    - a # can be either less than, equal to, or greater than another. So inequalities have either

      less than sign $<$

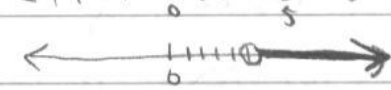
      or greater than sign $>$,

      also less than OR equal to ($\leq$) and greater than OR equal to ($\geq$) are also possible.
- How are inequalities graphed?
  - with $=$, there is only one solution
  - How many solutions are there with inequalities? ∞!
  - a graph is a visual representation of a solution. For one solution, there is a dot on a set of coordinates. For many solutions, we shade the areas that represent our solutions. In this case, we use # line

ex: graph $x = 5$



graph $x > 5$



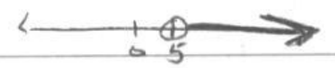
★ shade all #s strictly greater than 5. Make open circle around 5 since we don't want to shade it but show that we shade all #s infinitely close to 5 graph $x < 5$ 

graph $x \geq 2$ 

☆ make closed circle around 2 since it is included in our solution.

- What is interval notation?
  - same as we used open and closed circles, we use round and square brackets.
  - Interval notation is similar to the picture and is read from left to right

ex: $x > 5$ $x \leq 3$



$(5, \infty)$ $(-\infty, 3]$

↑ left endpoint   right endpoint (∞ never included)

( ) ← same as open circle, endpt <u>not</u> included

[ ] ← same as closed circle, endpt <u>IS</u> included

- How can we solve linear inequalities?
  - Solve exactly the same way as you solve equalities

<u>BUT</u>

if while you're solving you divide or multiply both sides of the inequality sign by a NEGATIVE #, reverse the sign

ex: $\frac{-3x}{-3} > \frac{6}{-3}$

☆ $x < -2$

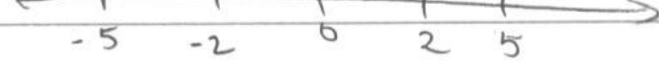
ex: $-2x + 3 \leq 9$

$-3 \quad -3$

$\frac{-2x}{-2} \leq \frac{6}{-2}$

☆ $x \geq -3$

-Why?



$-2 > -5$ $\quad$ $2 < 5$

(greater than just means to the right on the # line)

So x or ÷ by neg brings us into opposite side of line where the rules are inverted.

$2 < 5$

$(-1)2 < 5(-1)$ mult. by -1 on both sides

$-2 < -5$ NOT TRUE! Sign must flip

$-2 > -5$

Can check:

ex. $\frac{-3x}{-3} < \frac{6}{-3}$

$x < -2$ Is this right? Try $x = -3$, since $-3 < -2$

Plug into original

$-3(-3) < 6$?

$9 < 6$? No!

Thus $x > -2$ (sign flipped)

Try $x = 0$, $0 > -2$.

$-3(0) < 6$

$0 < 6$ Yes! So we know it's right