Solving Linear Inequalities
(One Variable)

Level 1 - Solve and graph simple linear inequalities
Level 2 - Solve and graph multi-step inequalities
Level 3 - Solve and graph compound inequalities

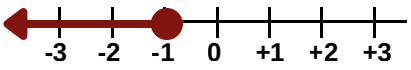
Linear inequalities are similar to linear equations, but instead of an equal sign (=), they use symbols like **<**, **>**, **≤**, or **≥**. These symbols show a range of possible solutions rather than one exact answer.

When solving inequalities, the rules for isolating the variable are almost the same as equations, except for one important difference:

When you **multiply or divide both sides by a negative number**, you must **flip the inequality sign**.

To solve and graph a linear inequality:

1. Isolate the variable (just like solving for x in an equation).
2. Reverse the inequality sign when multiplying or dividing by a negative.
3. Represent the solution on a number line:
   - Open circle (○) for < or >
   - Closed circle (●) for ≤ or ≥

Example #1	**Example #2**	**Example #3**
$x + 4 > 3$	$-3x + 2 < 11$	$-4(3x - 2) \geq 2(x + 3) + 16$
$x + 4 > 3$ $-4 \quad -4$ $x > -1$  	$-3x + 2 < 11$ $-2 \quad -2$ $-3x < 9$ $\frac{-3x}{-3} < \frac{9}{-3}$ *dividing by a negative means we need to switch the sign* $x > -3$  	$-12x + 8 \geq 2x + 6 + 16$ $-12x + 8 \geq -2x + 22$ $-14x \geq 14$ $x \leq -1$ 

Remember:

- Always flip the inequality sign when multiplying or dividing by a negative number.
- Draw a quick number line to visualize your solution.

Compound Inequalities

Compound inequalities are like combining two mini-inequalities into one statement. They describe a range of possible values or multiple solution regions on a number line.

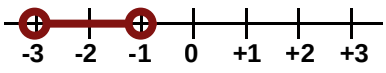
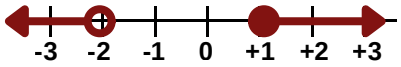
There are two main types:

- “AND” inequalities show values that make both inequalities true (the overlap).
- “OR” inequalities show values that make either inequality true (the union).

Think of “and” as where both conditions meet, and “or” as anywhere at least one works.

“***AND”*** **Example:** 2 < x < 6 means x is greater than 2 and less than 6 (x is between 2 and 6).

“***OR”*** **Example:** x < -3 or x > 5 means x is less than –3 or greater than 5.

“*AND*” Example $1 < -3x - 2 < 7$	**“*OR*” Example** $2x - 1 \geq 1$ *or* $-2x - 2 > 2$
split into two inequalities: $1 < -3x - 2$ *and* $-3x - 2 < 7$ $3 < -3x$ *and* $-3x < 9$ $-1 > x$ *and* $x > -3$ *so,* $-3 < x < -1$  	$2x \geq 2$ *or* $-2x > 4$ $x \geq 1$ *or* $x < -2$ 

Remember:

- For “and”, find where the solution sets overlap.
- For “or”, combine all values that satisfy either part.
- Always graph your final answer.