Inequalities

An inequality is an equation where instead of an equal sign, we have either a:
-Less than sign (<)
-Greater than sign (>)
-Less than or equal to sign (≤)
-Greater than or equal to sign (≥)

How do we interpret each sign?
- < means the left hand side must always be less than the right hand side
- > means the left hand side must always be more than the right hand side
- ≤ means the left side must always be less than or equal to the right hand side
- ≥ means the left side must always be greater than or equal to the right hand side

An inequality reads exactly like a normal equation, except instead of saying "equals", we say the corresponding sign.
Examples:
2x ≤ 4: 2x is less than or equal to 4
5x < 6: 5x is less than 6
4x + 2 ≥ 9: 4x + 2 is greater than or equal to 9
3x – 2 > 4: 3x – 2 is greater than 4

Inequalities can be balanced/simplified exactly like a normal equation, except for 1 twist: if we multiply or divide by a negative number, the sign must be flipped. This means that the greater than sign becomes less than, and vice-versa. In addition, the greater than or equal to sign becomes a less than or equal to sign, and vice-versa.

Example:
$-3y \geq 15$
Let's say we only want y on the left side with no -3. Naturally we divide both sides by -3, and we will end up with:
$y \leq -5$
If we didn't invert the sign, would the answer still be correct? Let's check.
We would have **$y \geq -5$** instead.
If we plug -5 into the above equal and the original equation, we get $-5 \geq -5$ and $-15 \geq -15$ respectively, so it seems to be correct as of right now.
But what if we plug in y = -7, which is a solution to the original equation? (If we plug in -7 into the original equation, we obtain: $21 \geq 15$, which is valid)
Plugging -7 into $y \geq -5$, we get $-7 \geq -5$, which is not a correct statement.