Solving Inequalities

Solving inequalities is not that much different than solving equations. Instead of having an equal sign divide the two sides, there is an inequality sign.

However, there is one really important rule:

if you multiply or divide by a negative number you have to *flip* the inequality sign.

For example, let's look at $-2x + 3 > 5$.

$-2x + 3 > 5$	*solve like you would -2x + 3 = 5*
$-2x + 3 - 3 > 5 - 3$	*subtract three from each side*
$-2x > 2$	*simplify*
$\frac{-2x}{-2} > \frac{2}{-2}$	*divide each side by -2*
$x < -1$	*switch the sign from > to <*

With this last example, if we had divided by positive two instead of negative two, we would have found that $-x > 1$. So, $x < -1$ and $-x > 1$ are really the same thing! That's why we have to switch the sign when we divide or multiply by a negative.

Since we divided by a -2, we switched the sign from > to <. Now, just like equations we can check our answers. Since x < -1, to check pick any number less than -1 and plug it into the original inequality (we picked -2).

$-2(-2) + 3 > 5$

$4 + 3 > 5$

$7 > 5$

Well 7 *is* greater than 5 so we can be pretty confident that we solved this correctly. However, unlike equations, we can't be completely sure. If you want to double check your work, that wouldn't be a horrible idea.

Look Out: *only switch the inequality sign if you multiply or divide by a negative number. You do not switch it if you add or subtract a negative number.*

Graphing Inequalities

Inequalities are exactly like they sound, equations where the sides are "inequal" (not equal) to each other. There are five basic inequalities that you need to be familiar with:

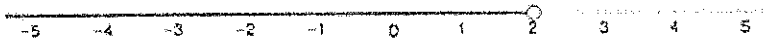
Symbol	Meaning
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
≠	not equal to

The inequality y ≤ 2 means that y can be a number less than 2 (1.9, ¾, 0, -6, etc...) or it can be equal to 2.

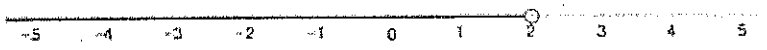
How to graph inequalities

1. Draw a circle around the number to which the variable is unequal.
2. Fill in the circle if and only if the variable *can* also equal that number.
3. Shade all numbers the variable can be.

Here is what y ≤ 2 looks like:



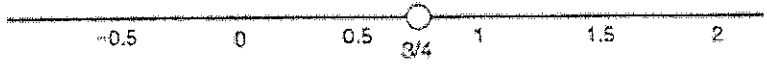
Here is what y < 2 looks like:



Notice the subtle difference between the two graphs. In the first graph the circle around the 2 is colored in. This is because y *can* be 2 in the first, but not the second.

Example

e ≠ ¾



Here the variable can be any number besides ¾, so we need to shade in everything that is not ¾.

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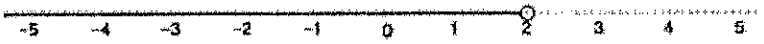

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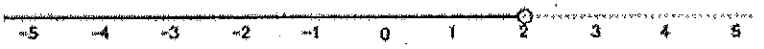

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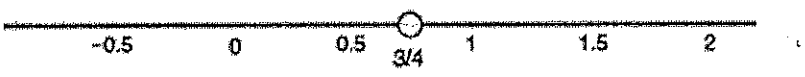
Example

$e \neq ¾$



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Example:

Solve for y:

$3y + 2 > 12 - y$

Here you can choose which side of the inequality to get the variables on. It's really up to you and whatever way makes more sense. In this problem, we will move the variables to the left side.

$3y + 2 > 12 - y$	
$3y + 2 + y > 12 - y + y$	*add y to each side*
$4y + 2 > 12$	*remember y is the same as 1y*
$4y + 2 - 2 > 12 - 2$	*subtract 2 from each side*
$4y > 10$	*simplify*
$\frac{4y}{4} > \frac{10}{4}$	*divide each side by 4*
$y > \frac{5}{2}$ *or* 2.5	*notice that the sign didn't switch*

*remember if the variable ends up on the right side, flip the inequality around.