Solving Linear Equations

1. **Does your equation have parentheses?**
   - **Yes** – Use the distributive property to eliminate the parentheses.
   - **No** – Go to Step 2
2. **Does your equation have fractions?**
   - **Yes** – Multiply EVERY term on BOTH SIDES by the Least Common Denominator (LCD)
   - **No** – Go to Step 3
3. **Does your equation have decimals?**
   - **Yes** – Determine the largest # of digits to the right of each decimal and then move the decimal for EVERY term that # of places to the right.
   - **No** – Go to Step 4
4. **On either side, do you have like terms?**
   - **Yes** – Combine like terms on each side separately. Do NOT use Opposite Operations!
   - **No** – Go to Step 5
5. **Do you have variables and/or constants on both sides of the equation?**
   - **Yes** – Use the Addition Principle (Opposite Operations) to move/combine the variable terms on one side of the equation and the constant terms on the other side of the equation. Remember, what you do to one side you must do to the other.
   - **No** – Go to Step 6
6. **Do you have a number multiplied by the variable?**
   - **Yes** – Use the Multiplication Principle to divide both sides of the equation by that number. You should now have the solution.
   - **No** – You should now have the solution to the equation.

Examples:

1. $2x-7=5$

We can skip to Step 5.

$$2x-7=5$$
$$+7\quad +7$$
$$\frac{2x}{2}=\frac{12}{2}$$
$$x=6$$

2. $3x+1=2x-3$

We can skip to Step 4.

$$3x+1=2x-3$$
$$-2x\quad -2x$$
$$x+1=-3$$
$$-1\quad -1$$
$$x=-4$$

3. $x-4+2x=10-x+2$

We can skip to Step 3.

$$x-4+2x=10-x+2$$
$$3x-4=12-x$$
$$+x\qquad +x$$
$$4x-4=12$$
$$+4\quad +4$$
$$\frac{4x}{4}=\frac{16}{4}$$
$$x=4$$

4. $\frac{1}{2}x+9=\frac{2}{3}x$

We can skip to Step 2.

$$\frac{1}{2}x+9=\frac{2}{3}x$$
$$6\left(\frac{1}{2}x+9\right)=6\left(\frac{2}{3}x\right)$$
$$3x+54=4x$$
$$-3x\qquad -3x$$
$$54=x$$

5. $-\frac{3}{4}(x-8)+2x=\frac{1}{3}(-2x+3)$

$$-\frac{3}{4}x+6+2x=-\frac{2}{3}x+1$$
$$12\left(-\frac{3}{4}x+6+2x\right)=12\left(-\frac{2}{3}x+1\right)$$
$$-9x+72+24x=-8x+12$$
$$15x+72=-8x+12$$
$$+8x\qquad +8x$$
$$23x+72=12$$
$$-72\quad -72$$
$$\frac{23x}{23}=\frac{-60}{23}$$
$$x=-\frac{60}{23}$$

6. $-0.12x+3.4=0.84+5x$

We can skip to Step 3.

$$-0.12x+3.4=0.84+5x$$
$$-12x+340=84+500x$$
$$-500x\qquad -500x$$
$$-512x+340=84$$
$$-340\quad -340$$
$$\frac{-512x}{-512}=\frac{-256}{-512}$$
$$x=\frac{1}{2}$$

Helpful YouTube videos:
1) https://www.youtube.com/watch?v=bAerID24QJ0
2) https://www.youtube.com/watch?v=DopnmxeMt-s
3) https://www.youtube.com/watch?v=Zn-GbH2S0Dk
4) https://www.youtube.com/watch?v=X7RVhbvl6kE

Solving Linear Inequalities

> "Is greater than"	**≥** "Is greater than or equal to"
< "Is less than"	**≤** "Is less than or equal to"

How do you solve a linear inequality? If you can solve a linear equation (see other side), then you can already solve a linear inequality because the procedure is almost entirely the same. The only difference is that you have to watch out for one special situation…

IF YOU MULTIPLY OR DIVIDE BY A *NEGATIVE* NUMBER TO GET X BY ITSELF DURING THE SOLVING PROCESS, THEN YOU MUST *FLIP THE INEQUALITY SIGN AROUND*!!!

In other words, **>** becomes **<**, and **≥** becomes **≤**.

Examples:

1. $-3x \le -7 - 5x$
   $+5x \quad +5x$
   $\frac{2x}{2} \le \frac{-7}{2}$
   $x \le -\frac{7}{2}$

2. $\frac{-x}{-1} > \frac{2}{-1}$
   We divided by a negative!!! Flip > to <.
   $x < -2$

3. $6 < 2x + 4$
   $-4 \quad -4$
   $\frac{2}{2} < \frac{2x}{2}$
   $1 < x$
   We prefer to have the x on the left. So, flip the entire answer around.
   $x > 1$

4. $-7 < 3x - 4 \le 8$
   This is called a double inequality. The goal is to get x by itself between the two inequality signs.
   $-7 < 3x - 4 \le 8$
   $+4 \quad +4 \quad +4$
   $\frac{-3}{3} < \frac{3x}{3} \le \frac{12}{3}$
   $-1 < x \le 4$

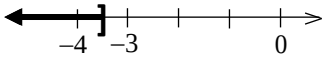
GRAPHING & INTERVAL NOTATION

You will usually be required to graph your solutions and to write your solutions in interval notation. When graphing, set up a number line, mark the number indicated in your solution, use a parenthesis or bracket on the number depending on whether you have simply < or >, in which case you use a parenthesis, or if you have ≤ or ≥, in which case you use a bracket. Then, you shade the rest of the solution. A good rule to use is that you shade in the direction the inequality is pointing (as long as the x is written on the left of the inequality sign).

Let's graph the solutions from above. The interval notation follows directly from the graph; just remember that ∞ and $-\infty$ always have a parenthesis in interval notation.

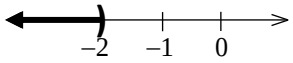
1. $x \le -\frac{7}{2}$

   Note: $-\frac{7}{2} = -3\frac{1}{2}$

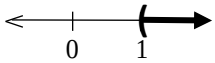
   $\left(-\infty, -\frac{7}{2}\right]$

2. $x < -2$

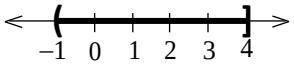
   $(-\infty, -2)$

3. $x > 1$

   $(1, \infty)$

4. $-1 < x \le 4$

   $(-1, 4]$

Helpful YouTube Video: https://www.youtube.com/watch?v=Z11RVIA6Yww