Graphing Linear Inequalities:

A **linear inequality** in two variables has the following possible forms:

1) $ax+by \leq c$, or
2) $ax+by < c$, or
3) $ax+by \geq c$, or
4) $ax+by > c$

Where $a,b,c \in \mathbb{R}$ and $(a,b) \neq (0,0)$

Ex.
Graph the inequality:

$$x+3y \geq 6 .$$

Note: The points on the line x+3y=6 will be a part of the solution set of the above inequality.

Step 1: Find the x and y intercepts of $x+3y=6$. (Two points determine a line).

Step 2: Since the inequality is of the form $\geq$, we will draw a solid line passing through the intercepts, otherwise we will draw a dashed line.

Step 3: The points lying on the line in step 2 are part of the solution set but there are others as well. In fact, the line separates the plane in two half-planes: The upper plane and lower planes. The plane containing the points satisfying the inequality will give the solution to the inequality.

To find the solution: We choose a point (We will call this the test point) not on the boundary and evaluate the inequality at those values. If the statement is True, then the solution set is that region. If the statement is False, the solution set is the other region.

Step 4: Shade the appropriate region.

Note: The point (0,0) is a good test point to use as long as it is not on the boundary.

Another way to identify the region satisfying the inequality is to solve the inequality for y. Remember the various rules for inequalities.

a) When multiplying or dividing through an inequality by a negative number, we must change the direction of the inequality.
b) When taking reciprocals on *both sides*, we must change the direction of the inequality.