

## Solving Systems of Linear Inequalities

Solving a system of linear inequalities is similar to solving system of linear equations but with inequalities we are not finding a point (or points) of intersect. Instead the solution set will be the region that satisfies all of the linear inequalities. The best way to solve a system of linear inequalities is to use the graphical method discussed in earlier sections.

When solving a system of linear inequalities graphically we will follow these steps:

1. Solve the inequality for  $y$ .
2. Treat the inequality as a linear equation and graph the line as either a solid line or a dashed line depending on the inequality sign.
  - a. If the inequality sign does not contain an equals sign ( $<$  or  $>$ ) then draw the line as a dashed line.
  - b. If the inequality sign does have an equals sign ( $\leq$  or  $\geq$ ) then draw the line as a solid line.
3. Shade the region that satisfies the inequality
4. Repeat steps 1 – 3 for each inequality
5. The solution set will be the overlapped region of all the inequalities

**Example 1:** Determine the solution to the following system of inequalities.

$$5x - 2y \leq 10$$

$$3x + 2y > 6$$

### Solution

**Step 1: Solve the inequality for  $y$**

$$5x - 2y \leq 10$$

$$-2y \leq -5x + 10$$

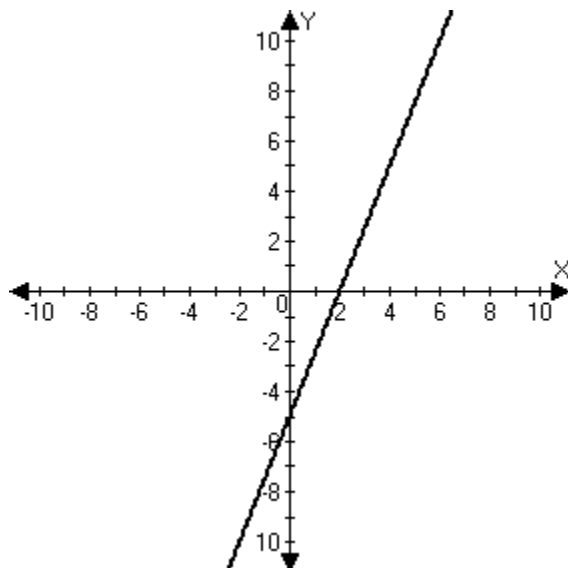
$$y \geq \frac{5}{2}x - 5$$

When dividing by a negative number, remember to switch the inequality sign.

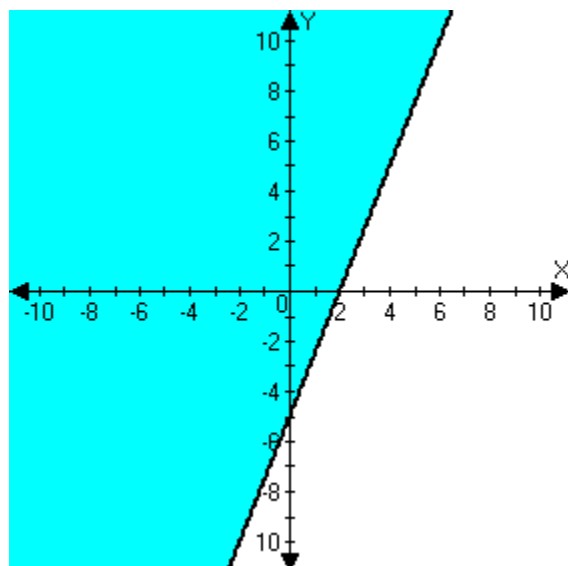
**Example 1 (Continued):****Step 2: Graph the boundary line for the inequality**

$$y \geq \frac{5}{2}x - 5$$

Since the inequality contains an equals sign the boundary line will be a solid line.

**Step 3: Shade the region that satisfies the inequality**

Since the inequality states the  $y$  must be greater than or equal to  $\frac{5}{2}x - 5$  the region to be shaded will be that above the boundary line.



**Example 1 (Continued):****Step 4: Solve the second inequality for y**

$$3x + 2y > 6$$

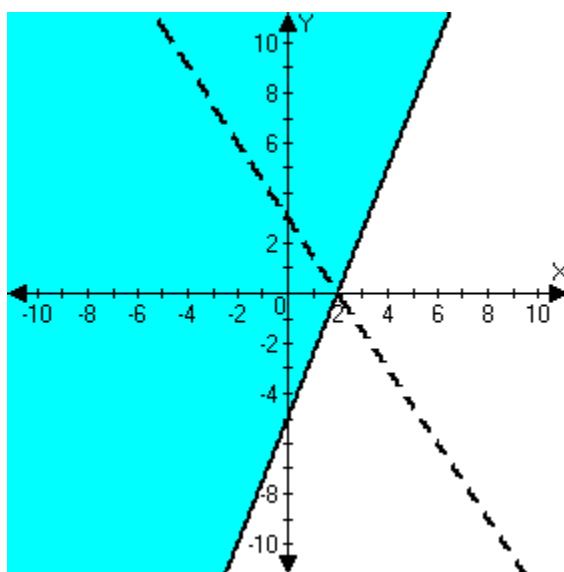
$$2y > -3x + 6$$

$$y > -\frac{3}{2}x + 3$$

**Step 5: Graph the boundary line for the second inequality**

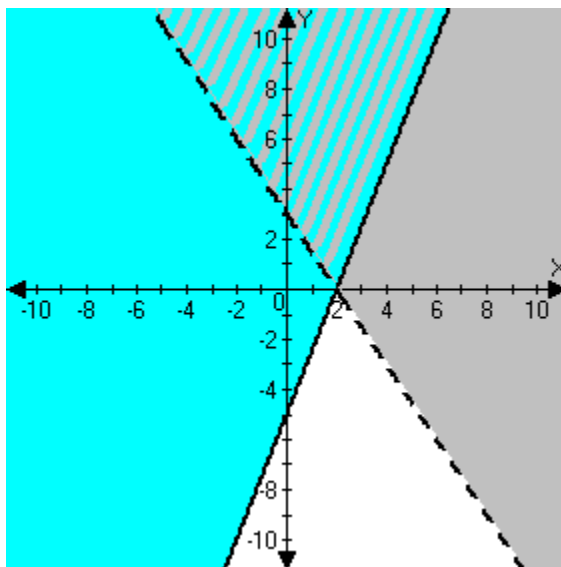
$$y > -\frac{3}{2}x + 3$$

Since the inequality does not contain an equals sign the boundary line will be a dashed line.



**Example 1 (Continued):****Step 6: Shade the region that satisfies the second inequality**

Since the inequality states the  $y$  must be greater than or equal to  $-\frac{3}{2}x + 3$  the region to be shaded will be that above the boundary line.

**Step 7: The solution set will be the overlapped region**

The solution set region (as shown in green) would include the part of the solid boundary line that is above the dashed boundary line but not the dashed boundary line itself.

