Finite Math - Spring 2017
Lecture Notes - 4/24/2017

HOMEWORK

- Section 5.2 - 9, 10, 11, 12, 16, 17, 18, 19, 20, 21, 24, 33

SECTION 5.2 - SYSTEMS OF LINEAR INEQUALITIES IN TWO VARIABLES
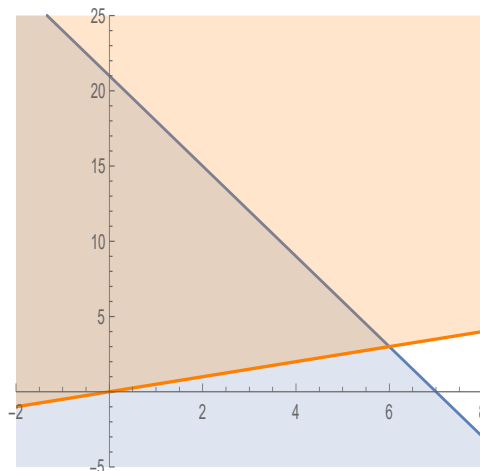
Solving Systems of Linear Inequalities Graphically.

Definition 1 (Solution Region/Feasible Region)**.** *Given a system of inequalities, the* solution region *or* feasible region *consists of all points (x, y) which simultaneously satisfy all of the inequalities in the system.*
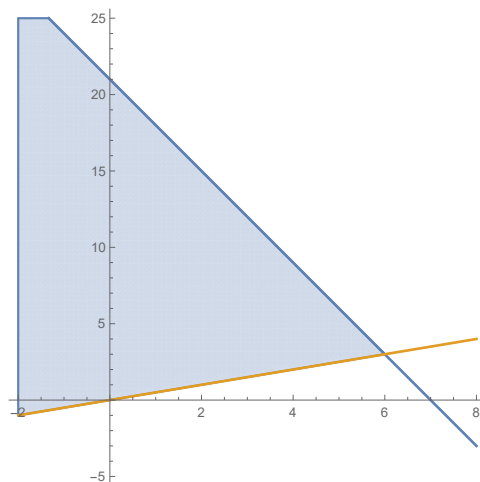
Example 1. *Solve the following system of linear inequalities graphically:*

$$\begin{array}{rcrcc} 3x & + & y & \leq & 21 \\ x & - & 2y & \leq & 0 \end{array}$$

Solution. *First we begin by graphing both inequalities on the same set of axes*

then we keep only the portion that the two graphs have in common

**Example 2.** *Solve the following system of linear inequalities graphically:*

$$\begin{aligned} 3x &+ y &\geq& 6 \\ x &- 5y &\leq& 5 \end{aligned}$$

Definition 2 (Corner Point). *A* corner point *of a solution region is a point in the solution region that is the intersection of two boundary lines.*
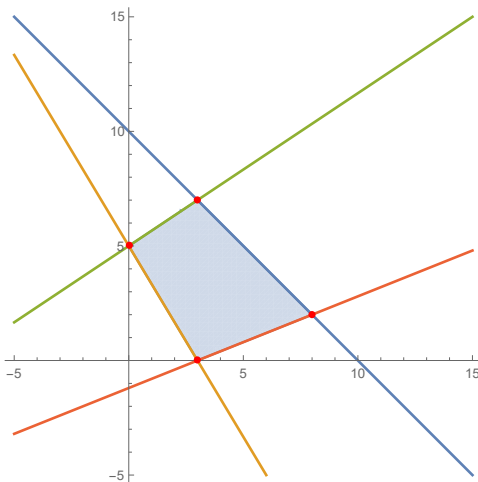
Example 3. *Solve the following system of linear inequalities graphically and find the corner points:*

$$\begin{aligned} x &+ y &\leq& 10 \\ 5x &+ 3y &\geq& 15 \\ -2x &+ 3y &\leq& 15 \\ 2x &- 5y &\leq& 6 \end{aligned}$$

Solution. *Begin by plotting all of the inequalities*
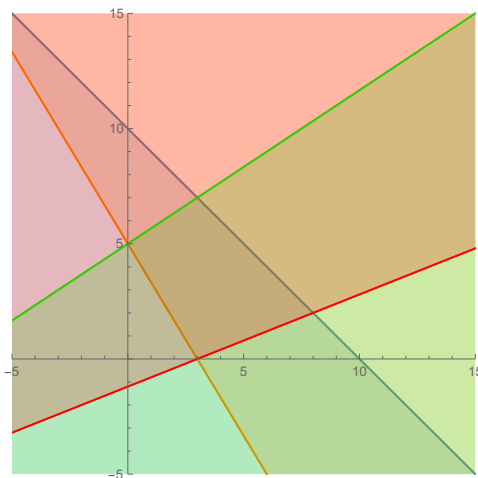
Blue is $x + y \leq 10$, orange is $5x + 3y \geq 15$, green is $-2x + 3y \leq 15$, and red is $2x - 5y \leq 6$. Then we keep only the portion that the four graphs have in common

In the above graph, the four corner points have been highlighted. To find these, we have to solve the systems of equations each intersection comes from. The intersections come from blue and green, blue and red, orange and green, and orange and

red. Using the graphing method AND CHECKING THE SOLUTIONS, we can find that the corner points are

colors	system	corner point
blue and green	$\begin{cases} x + y &= 10 \\ -2x + 3y &= 15 \end{cases}$	$(3, 7)$
blue and red	$\begin{cases} x + y &= 10 \\ 2x - 5y &= 6 \end{cases}$	$(8, 2)$
orange and green	$\begin{cases} 5x + 3y &= 15 \\ -2x + 3y &= 15 \end{cases}$	$(0, 5)$
orange and red	$\begin{cases} 5x + 3y &= 15 \\ 2x - 5y &= 6 \end{cases}$	$(3, 0)$

Example 4. *Solve the following system of linear inequalities graphically and find the corner points:*

$$\begin{aligned} 5x + y &\geq 20 \\ x + y &\geq 12 \\ x + 3y &\geq 18 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

Definition 3 (Bounded/Unbounded)**.** *A solution region of a system of linear inequalities is* bounded *if it can be enclosed within a circle. If it cannot be enclosed within a circle, it is* unbounded.

Question. *Which of the regions in examples 1-4 are bounded? Which are unbounded?*