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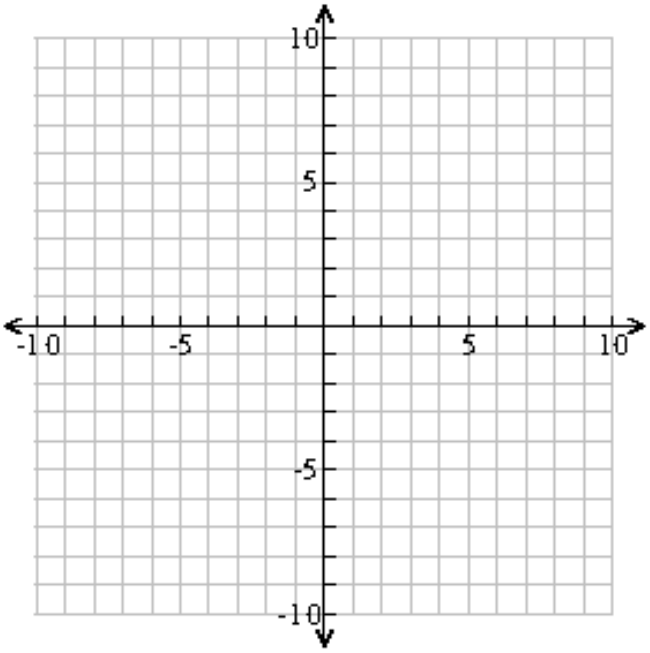
Section 3.1: Graphing Inequalities

Directions: Please read and outline section 3.1 before coming to class! Attempt Exercise 1, and from your book, fill in the blank definitions below.

Exercise 1. We are going to graph (without our calculator) the linear inequality $3x + 2y - 6 > 0$.

First, graph the line $3x + 2y - 6 = 0$. Use a dashed line to graph the line, since this is a strict inequality.

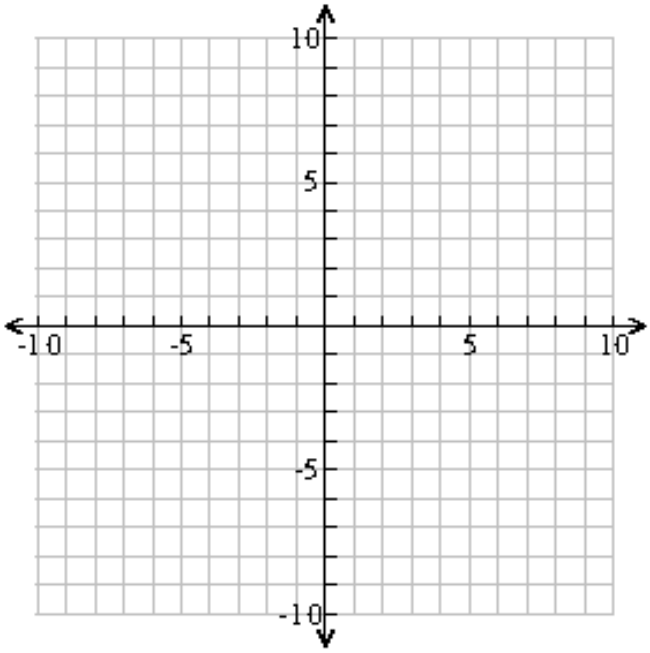


Now plug the point $(0, 0)$ into the inequality. Is the inequality true? If so, shade the side of the line that contains $(0, 0)$. Otherwise, shade the other side of the line.

[1]Some parts of these materials are modified from notes created by Joe Kahlig from TAMU. Used with permission. All errors are my own.

Definition. Procedure for graphing linear inequalities

Exercise 2. Using your work on Exercise 1, graph $3x + 2y - 6 \leq 0$.



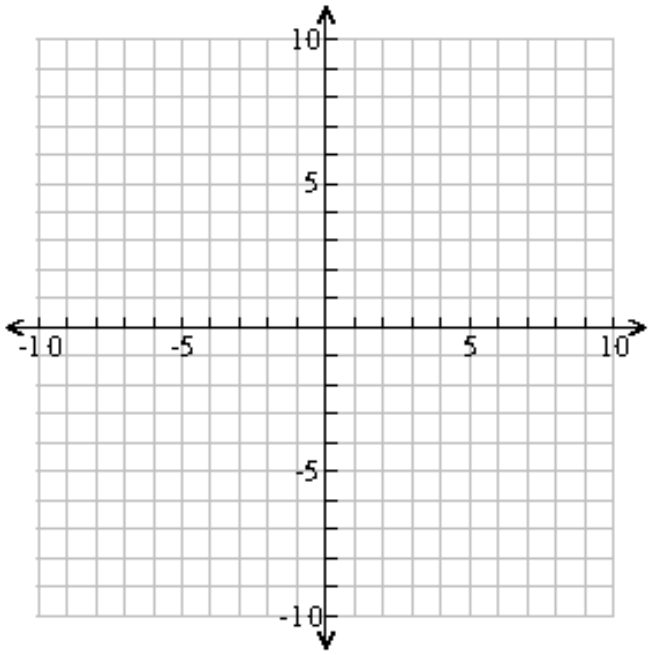
The reason we are going to graph inequalities today is because what we want to learn is how to solve **linear programming problems**.

Definition. linear programming problem
A **linear programming problem** consists of a linear function to be **maximized or minimized** subject to a set of constraints in the form of a system of linear equations or inequalities.

Definition. feasible region (FR)
The **feasible region (FR)**, sometimes called the **solution set**, for a system of inequalities is the set of points that satisfies all of the inequalities at the same time. The feasible region is usually illustrated graphically in the xy-plane.

Exercise 3. Sketch the feasible region for these inequalities (system of inequalities).

$$\begin{array}{rcrcl} 3x & + & 2y & \leq & 16 \\ x & - & y & \leq & 2 \\ & & x,\ y & \geq & 0 \end{array}$$



Definition. bounded and unbounded solution sets

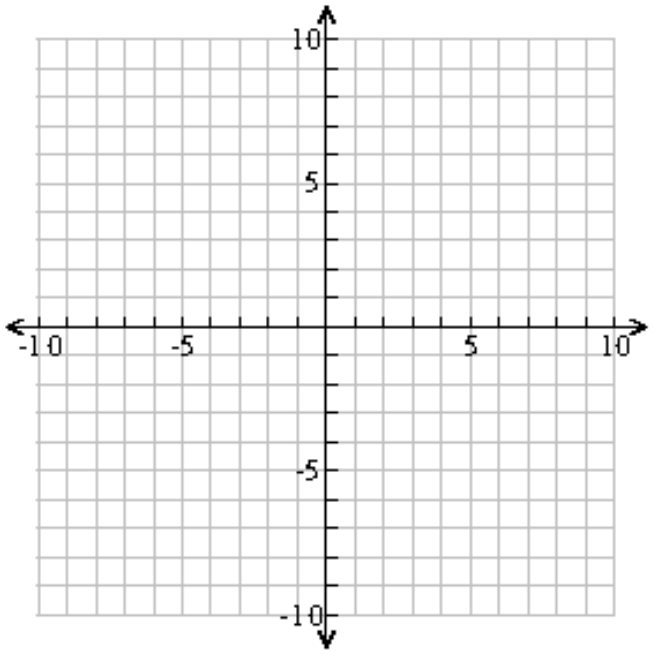
Definition. corner points
The intersection of two inequalities (if it exists), is called a **corner point** of the feasible region (or solution set), provided that this point is part of the feasible region.

Exercise 4. Find all the corner points for the system of inequalities we graphed in Exercise **??**.

$$\begin{array}{rcrcl} 3x & + & 2y & \leq & 16 \\ x & - & y & \leq & 2 \\ & & x,\ y & \geq & 0 \end{array}$$

Exercise 5. Sketch the feasible region and find all the corner points for

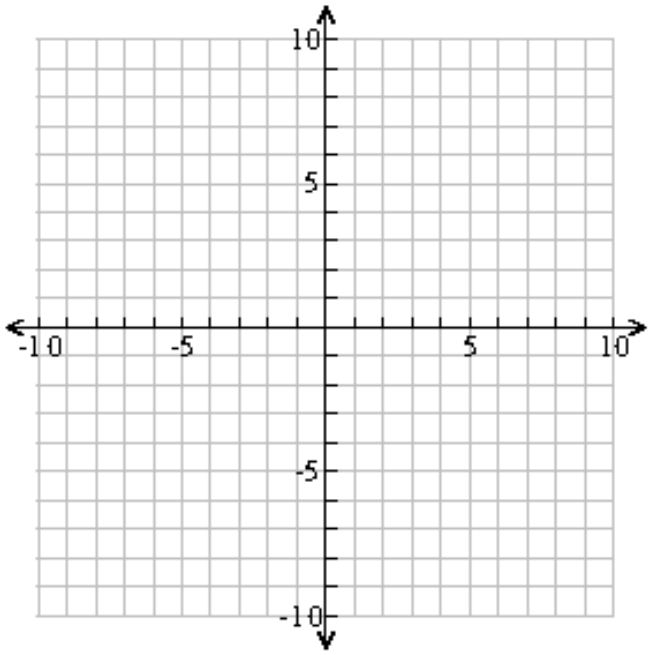
$$\begin{array}{rcrcl} x & + & y & \leq & 2 \\ 3x & + & y & \geq & 6 \\ x & + & 3y & \geq & 6 \end{array}$$



Is this feasible region bounded?

Exercise 6. Determine the feasible region for this system of inequalities. Find all corner points and determine if the feasible region is bounded.

$$\begin{array}{rcrcl} x & + & y & \leq & 6 \\ x & + & y & \geq & 2 \\ 2x & - & y & \geq & 0 \\ & & x & \leq & 5 \\ & & y & \leq & 6 \\ & & x,\ y & \geq & 0 \end{array}$$



Exercise 7. Determine the feasible region for this system of inequalities. Find all corner points and determine if the feasible region is bounded.

$$\begin{aligned} x + y &\leq 6 \\ x + y &\geq 2 \end{aligned}$$