Section 3.1: Setting Linear Programming Problems

- Always Define Your Variables
- Objective Function
- Constraints

Pr 1. Set up, but do not solve.

A housing contractor wants to develop a 42 acre tract of land. He has three types of houses: a small 3 bedroom, a large 3 bedroom and a 4 bedroom house. The small three bedroom house requires \$70,000 of capital for a profit of \$20,000, the large three bedroom house requires \$84,000 of capital for a profit of \$25,000, and the four bedroom house requires \$100,000 of capital for a profit of \$24,000. The small three bedroom needs 3000 labor hours, the large three bedroom needs 3500 labor hours, and the 4 bedroom house needs 3900 labor hours. There are currently 250,000 labor hours available. If the small three bedroom house is on half an acre, the large 3 bedroom house is on 0.75 acres, the four bedroom house is on 1.5 acres and the contractor has 6 million in capital, how many of each type should be built to maximize the profit?

Variables:

_______:= ____

_______:= ____

_______:= ____

_______:= ____

⋮

Objective: Maximize/ Minimize ____

Subject to: ____

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Pr 2. Set up, but do not solve.

Your water bottle company sells bottles in 20 ounces (the Sprinkle), 30 ounces (the Storm), and 40 ounces (the Hurricane). The amount of glass (square yards), stainless steel(pounds), and plastic(pounds) used in making each model are given in the table.

	Glass	Steel	Plastic
Sprinkle	1	2	1
Storm	2	1	3
Hurricane	2	3	6

The profit for the Storm is \$1, for the Hurricane is \$2 and for the Sprinkle is \$1. Due to certain agreements, the company can make at most 250 Sprinkle bottles. If the company has 300 square yards of glass, 600 pounds of stainless steel, 800 pounds of plastic, how many of each type of water bottle should be produced in order to maximize the profit?

Pr 3. Solve using the methods below from Section 3.3.

You have \$15,000 to invest, some in Stock A and some in Stock B. You have decided that the money invested in Stock A must be at least twice as much as that in Stock B. However, the money invested in Stock A must not be greater than \$8,000. If Stock A earn 4% annual interest, and Stock B earn 5% annual interest, how much money should you invest in each to maximize your annual interest?

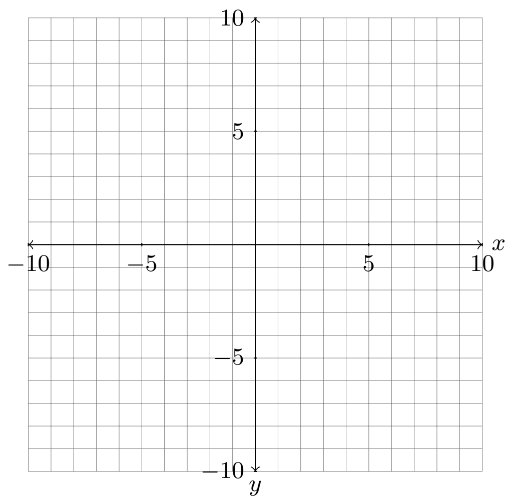
Pr 4. Set up, but do not solve.

An independent taffy company makes three flavors of taffy: strawberry, lemon, and orange. Each strawberry taffy requires 4 minutes to cool and 1 minute to wrap in paper. Each orange taffy requires 3 minutes to cool and 1.5 minutes to wrap in paper. Each lemon taffy requires 4 minutes to cool and 2 minutes to wrap in paper. There are a total of 1.5 hours available for cooling and 0.5 hours available for wrapping. Determine the production of each taffy to maximize profit if the profit on the sale of each orange, lemon, and strawberry taffy is 75 cents, 60 cents, and 50 cents, respectively, and previous sales indicate that they should produce at least three times as many strawberry taffy as lemon taffy. How many of each flavor should the company make to maximize their profits? What is the maximum profit and is any time leftover in cooling or wrapping?

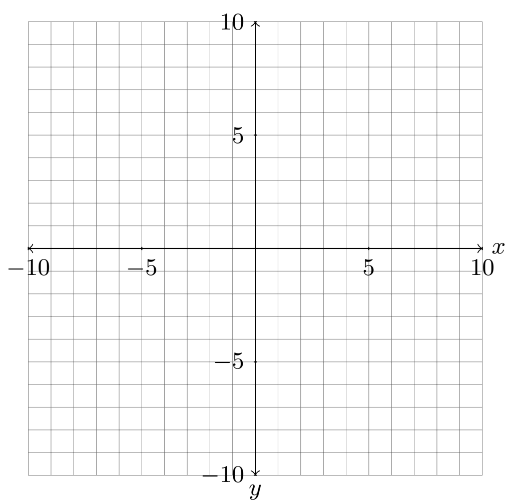
SECTION 3.2: GRAPHING SYSTEMS OF LINEAR INEQUALITIES IN TWO VARIABLES

- Solution set to a linear inequality is half of the coordinate plane, while the solution set to a system of linear inequalities is the region of points that satisfy **all** of the linear inequalities in the system.
- Boundary Line - the corresponding linear equation for a a linear inequality
- True Shading vs. Reverse Shading
- Unbounded vs. Bounded solution sets
- Corner Points

Pr 1. Graph the inequality $5x - 9y < 21$, labeling the boundary line and the solution set with **S**.



Pr 2. Graph the inequality $-4x + 7y \geq 0$, labeling the boundary line and the solution set with **S**.



Pr 3. Graph the system of linear inequalities, the solution set with **S**. Then state whether the solution set is bounded or unbounded and the exact corner point(s) of the solution set.

$$3x + y \leq 15$$
$$6x + 5y \geq 33$$
$$x + 2y \leq 15$$
$$x \geq 0, y \geq 0$$

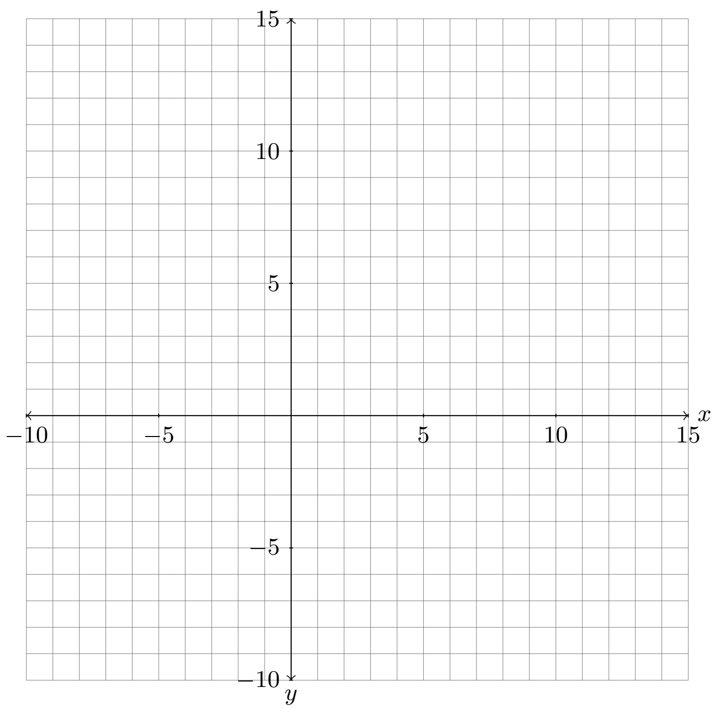
$3x + y \leq 12$ $\quad$ $6x + 5y \geq 30$ $\quad$ $x + 2y \leq 14$ $\quad$ $x \geq 0$ $\quad$ $y \geq 0$

Boundary Line:

***x*-intercept**:

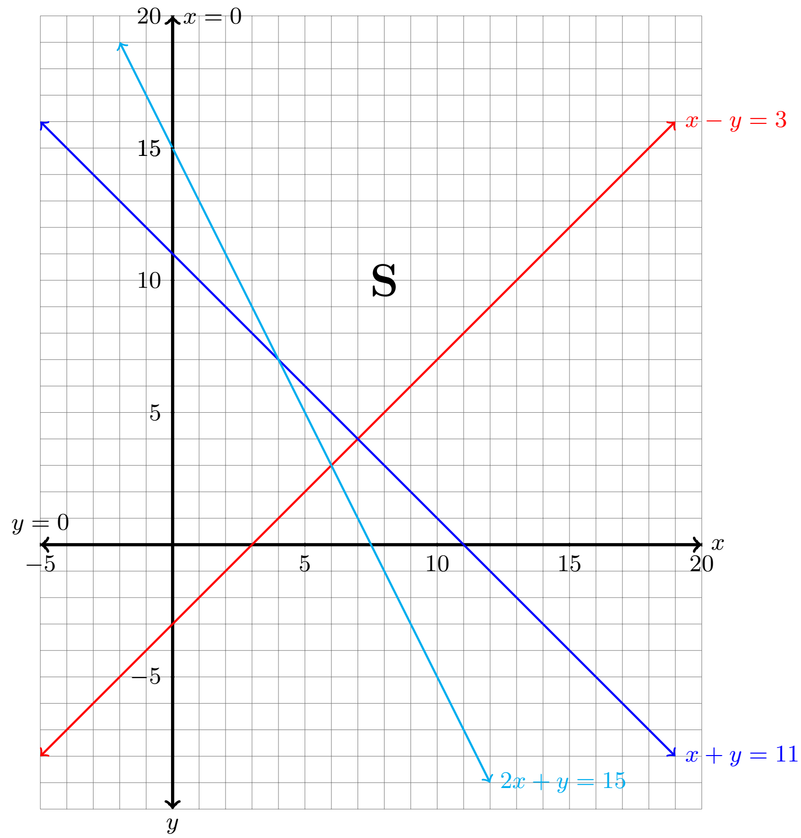
***y*-intercept**:

Test Point:



Corner Points:

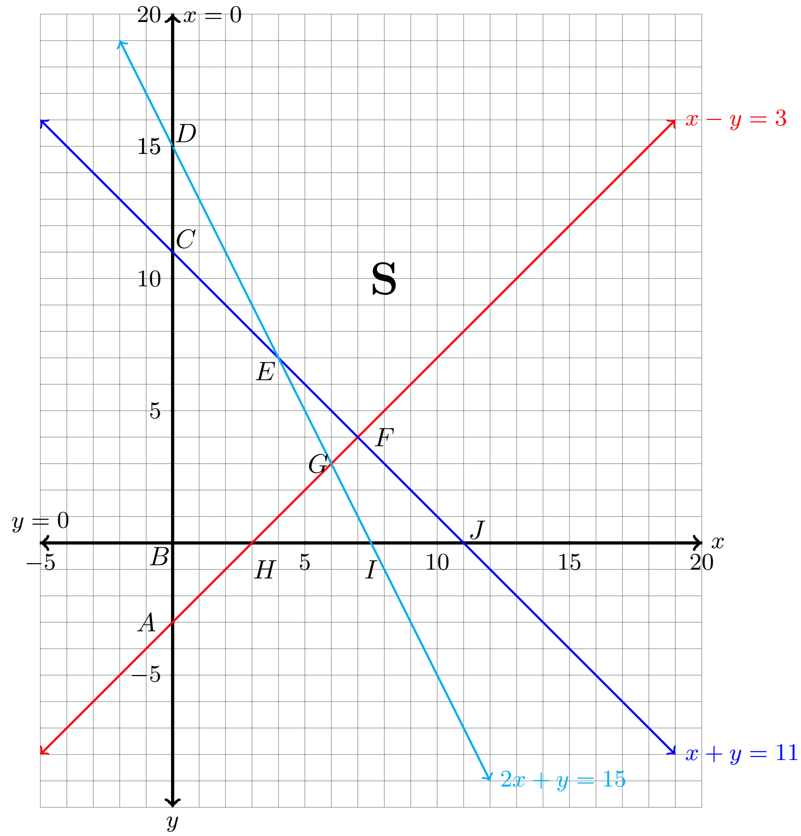
Pr 4. Use the graph below to write the corresponding system of linear inequalities.



Section 3.3: Graphical Solution of Linear Programming Problems

- Feasible Region
- Know the parts of the Fundamental Theorem of Linear Programming
- Method of Corners
  - Set up a linear programming problem algebraically.
  - Graph the constraints and determine the feasible region.
  - Identify the exact coordinates of all corner points of the feasible region.
  - Determine whether or not the linear programming problem will have a solution.
  - If a solution will exist, evaluate the objective function at each corner point and determine the optimal point.
- Leftovers

Pr 1. Use the feasible region to determine the maximum and minimum values of the objective function $z = 2x+y$ over the region, if they exist and where they occur.



(x, y)		
A: $(0, -3)$		
B: $(0, 0)$		
C: $(0, 11)$		
D: $(0, 15)$		
E: $(4, 7)$		
F: $(7, 4)$		
G: $(6, 3)$		
H: $(3, 0)$		
I: $(7.5, 0)$		
J: $(11, 0)$		

Pr 2. Use the Method of Corners to solve the following linear programming problem.

Objective: Maximize $P = 12x + 8y$

Subject to: $3x + y \leq 15$

$$6x + 5y \geq 33$$

$$x + 2y \leq 15$$

$$x \geq 0,\ y \geq 0$$

Pr 3. An independent taffy company makes three flavors of taffy: strawberry, lemon, and orange. Each strawberry taffy requires 4 minutes to cool and 1 minute to wrap in paper. Each orange taffy requires 3 minutes to cool and 1.5 minutes to wrap in paper. Each lemon taffy requires 4 minutes to cool and 2 minutes to wrap in paper. There are a total of 1.5 hours available for cooling and 0.5 hours available for wrapping. Determine the production of each taffy to maximize profit if the profit on the sale of each orange, lemon, and strawberry taffy is 75 cents, 60 cents, and 50 cents, respectively, and previous sales indicate that they should produce at least three times as many strawberry taffy as lemon taffy. How many of each flavor should the company make to maximize their profits? What is the maximum profit and is any time leftover in cooling or wrapping?