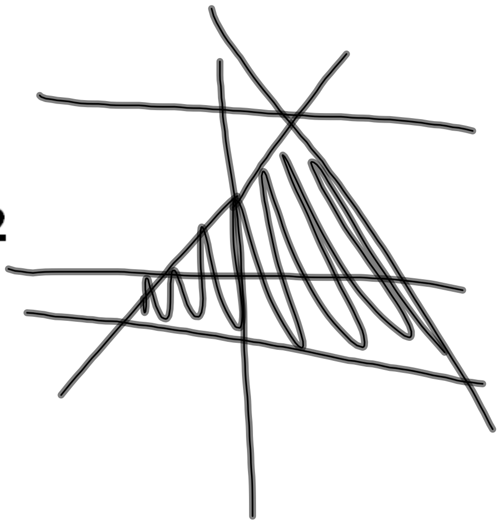
Warm up:

Graph the system of inequalities, and classify the figure created by the solution region.

$$\begin{cases} y \le 4 \\ y \ge -1 \\ y \le -x + 8 \\ y \le 2x + 2 \end{cases}$$

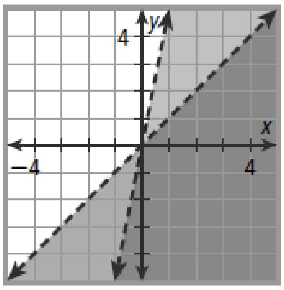


"Success is to be measured not so much by the position one has reached in life as by the obstacles which he has overcome trying to succeed."

-Booker T. Washington

11. $y < 5x$

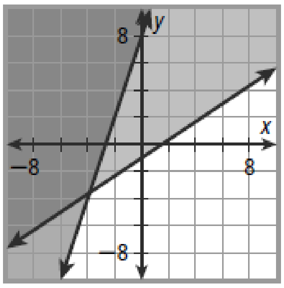
$y < x$



12. $3y \geq 2x - 3$

$y \geq \frac{2}{3}x - 1$

$y \geq 3x + 8$

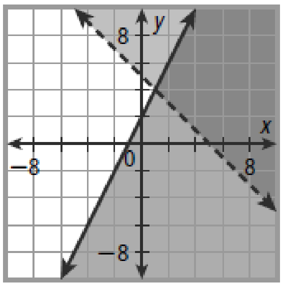


13. $x + y > 5$

$y > -x + 5$

$-2x + y \leq 2$

$y \leq 2x + 2$

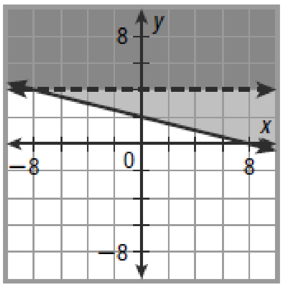


14. $y > 4$

$x + 4y \geq 8$

$4y \geq -x + 8$

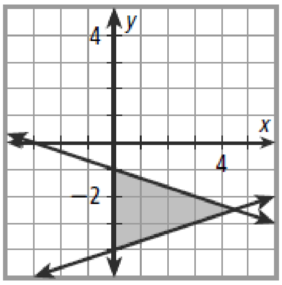
$y \geq -\frac{1}{4}x + 2$



16. $x \geq 0$

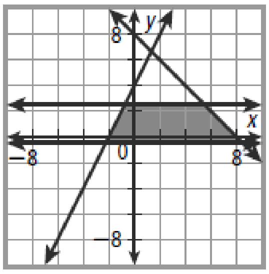
$y \geq \frac{1}{3}x - 4$

$y \leq -\frac{1}{3}x - 1$



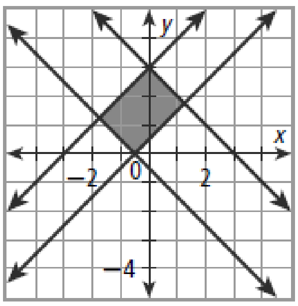
isoceles triangle

17.



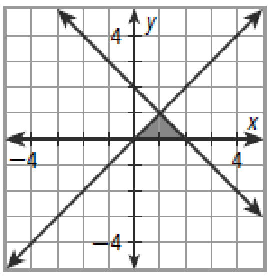
trapezoid

18.



rectangle

19.



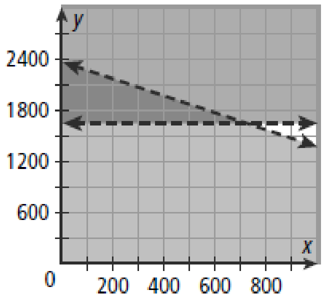
isoceles right triangle

20. Let x be the number of receiving yards, and y be the number of rushing yards.

$x + y < 2370$

$y < -x + 2370$

$y > 1645$



21. Possible answer:

$$\begin{cases} y \leq 2x \\ y \geq 2x - 1 \\ y \leq -\frac{1}{2}x \\ y \geq -\frac{1}{2}x + 3 \end{cases}$$

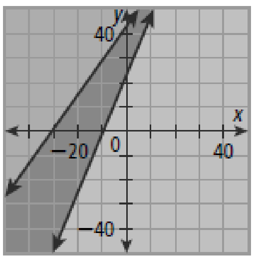
22. Possible answer:

$$\begin{cases} y \leq x + 2 \\ y \geq x - 3 \\ y \leq -x \\ y \geq -x - 5 \end{cases}$$

26a. Possible answer: $D = \{t \in \mathbb{R} \mid -40 \leq t \leq 40\}$

$R = \{w \in \mathbb{R} \mid w \geq 0\}$

b.



c. $w \geq 2.4(15) + 23$

$w \geq 59$ mi/h

$w \leq 1.4(15) + 43$

$w \leq 64$ mi/h

Possible answer: No, for a temperature of 15°F, the windspeed must be between 59 mi/h and 64 mi/h for a person to catch frostbite in 10 to 30 min.

34. D

35. G

36. C

3-4 Linear Programming

Objective

Solve linear programming problems.

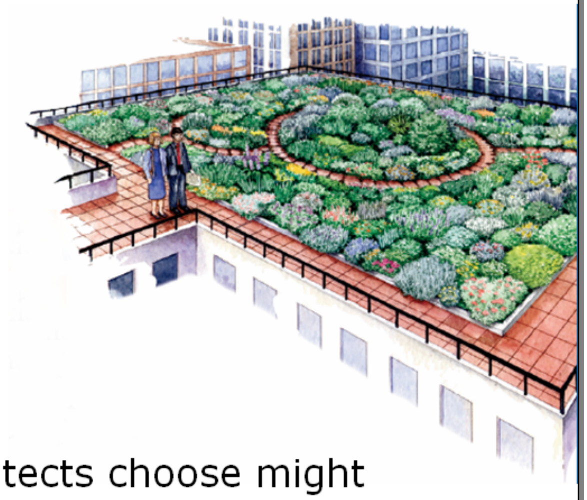
3-4 Linear Programming

Vocabulary

linear programming
constraint
feasible region
objective function

3-4 Linear Programming

Green roofs are covered with plants instead of traditional materials like concrete or shingles to help lower heat and improve air quality.



The plants landscape architects choose might depend on the price, the amount of water they require, and the amount of carbon dioxide they absorb.

3-4 Linear Programming

Linear programming is method of finding a maximum or minimum value of a function that satisfies a given set of conditions called *constraints*. A **constraint** is one of the inequalities in a linear programming problem. The solution to the set of constraints can be graphed as a **feasible region**.

To handle these problems:

1) Write all your inequalities.
2) Graph the inequalities.
3) Use the graph to find maximums, minimums, etc.

Yum's Bakery bakes two breads, *A* and *B*. One batch of *A* uses 5 pounds of oats and 3 pounds of flour. One batch of *B* uses 2 pounds of oats and 3 pounds of flour. The company has 180 pounds of oats and 135 pounds of flour available. Write the constraints for the problem and graph the feasible region.

(A = x, B = y)

O: $5x + 2y \leq 180$

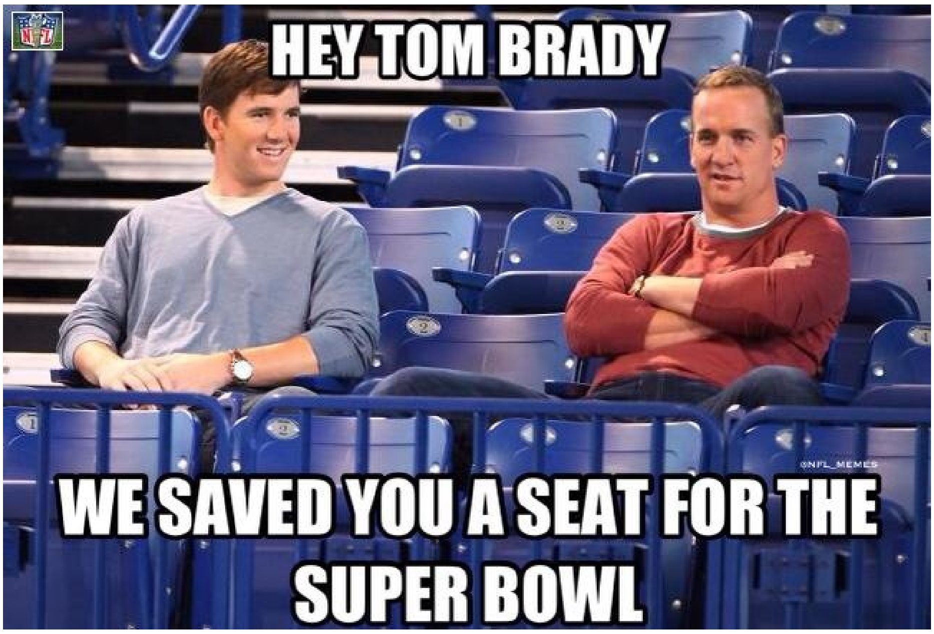
F: $3x + 3y \leq 135$

$x \geq 0$

$y \geq 0$

Graph the feasible region for the following constraints.

$$\begin{cases} x \geq 0 \\ y \geq 1.5 \\ 2.5x + 5y \leq 20 \\ 3x + 2y \leq 12 \end{cases}$$

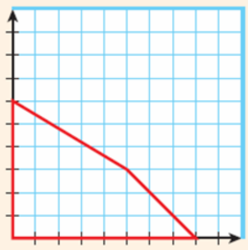
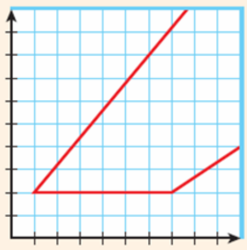


3-4 Linear Programming

In most linear programming problems, you want to do more than identify the feasible region. Often you want to find the best combination of values in order to minimize or maximize a certain function. This function is the **objective function**.

The objective function may have a minimum, a maximum, neither, or both depending on the feasible region.

3-4 Linear Programming

Bounded and Unbounded Regions	
Bounded Feasible Region	**Unbounded Feasible Regions**
	 
Objective function has both a minimum and a maximum value.	Objective function has either a maximum value or a minimum value but not both.

3-4 Linear Programming

More advanced mathematics can prove that the maximum or minimum value of the objective function will always occur at a vertex of the feasible region.

The Vertex Principle of Linear Programming

If an objective function has a maximum or minimum value, it must occur at one or more of the vertices of the feasible region.

What you need to know is that the max or min will always occur at a vertex/point on the graph.

To check to see which is the max or min you need to check every "point" of your figure. Whichever is highest will be your answer for a max problem

Yum's Bakery wants to maximize its profits from bread sales. One batch of *A* yields a profit of $40. One batch of *B* yields a profit of $30. Use the profit information and the data from Example 1 to find how many batches of each bread the bakery should bake.

x y

$P = 40x + 30y$

$40(0) + 30(45)$
$= 1350$

$40(30) + 30(15)$
$= 1650$

$40(36) + 30(0)$
$= 1350$

30 of A
15 of B

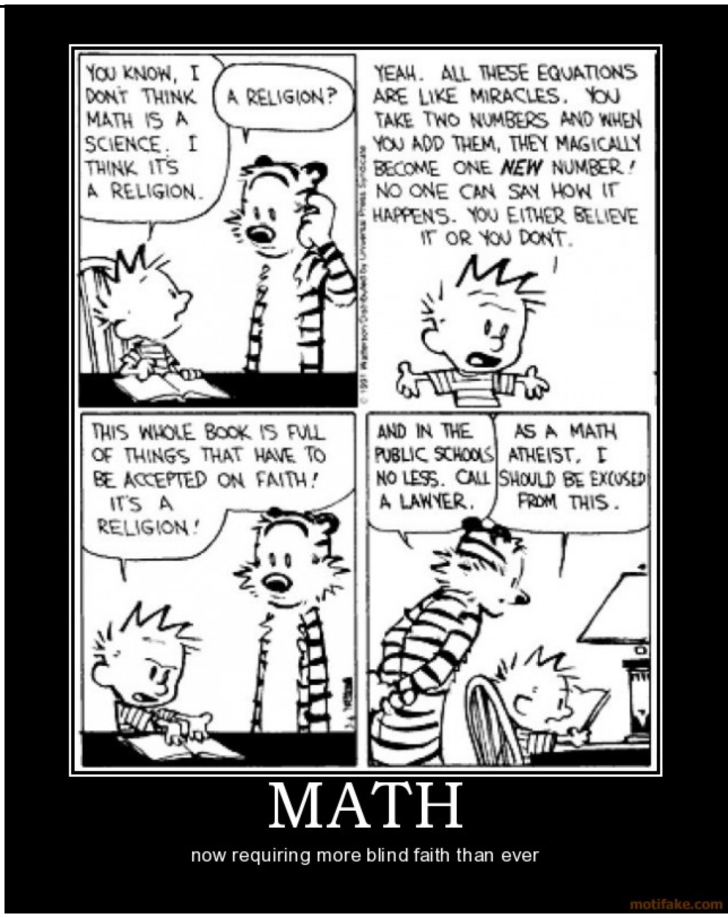
Maximize the objective function $P = 25x + 30y$ under the following constraints.

$$\begin{cases} x \geq 0 \\ y \geq 1.5 \\ 2.5x + 5y \leq 20 \\ 3x + 2y \leq 12 \end{cases}$$

(2, 3)

Sue manages a soccer club and must decide how many members to send to soccer camp. It costs $75 for each advanced player and $50 for each intermediate player. Sue can spend no more than $13,250. Sue must send at least 60 more advanced than intermediate players and a minimum of 80 advanced players. Find the number of each type of player Sue can send to camp to maximize the number of players at camp.

(130, 70)



A book store manager is purchasing new bookcases. The store needs 320 feet of shelf space. Bookcase A provides 32 ft of shelf space and costs $200. Bookcase B provides 16 ft of shelf space and costs $125. Because of space restrictions, the store has room for at most 8 of bookcase A and 12 of bookcase B. How many of each type of bookcase should the manager purchase to minimize the cost?

Homework:

p. 209 #9-14, 23, 27-29,