

Sec 3-4 Linear Programming

A technique that finds the Maximum or Minimum value of a quantity that meets a set of constraints.

The **OBJECTIVE FUNCTION** is what you are ultimately trying to either maximize or minimize.

The Corner-Point Principle:

Any maximum or minimum value of a linear combination of variables will occur at one of the vertices of the feasible region (shaded region).

A farmer wants to plant some acres of soybeans and/or wheat this season.

- The farmer has up to 240 acres of land to use for these crops.
- The farmer has only enough seed for at most 180 acres of wheat.

Define variables and write four inequalities to model the constraints in this situation.

W = # acres of wheat
 S = # acres of Soybean

$$W \geq 0 \quad S \geq 0$$

$$W \leq 180 \quad S + W \leq 240$$

S = # acres of Soybean

W = # acres of Wheat

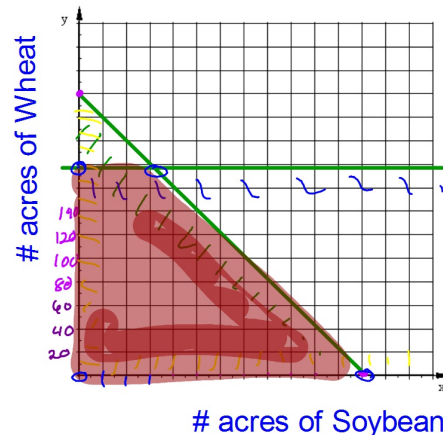
$$S \geq 0$$

$$W \geq 0$$

$$S + W \leq 240$$

$$W \leq 180$$

$(0,0)$
 $(0,180)$
 $(240,0)$
 $(60,180)$



Suppose that the farmer can sell the Soybeans for \$150 an acre and the Wheat for \$200 an acre.

How many acres of each should be planted in order to maximize the income?

$$I = 150S + 200W$$

By planting 60 acres of Soybeans and 180 acres of Wheat, the farmer will make the most money.

(S,W)	$150S + 200W$
$(0,0)$	\$0
$(0,180)$	\$36,000
$(240,0)$	\$36,000
$(60,180)$	\$45,000

The Corner-Point Principle:

Any maximum or minimum value of a linear combination of variables will occur at one of the vertices of the feasible region (shaded region).

7. Basketballs cost \$9 each and footballs cost \$24 each.
 You can spend no more than \$144 on balls for the two teams.
 You only have enough room on the equipment cart for 11 more balls.

a) Write a system of **four** inequalities to represent the constraints given.

B = # of basketballs
 F = # of footballs

$$F \geq 0 \quad B \geq 0$$

$$B + F \leq 11$$

$$9B + 24F \leq 144$$

b. Graph this system of inequalities

$$F \geq 0 \quad B \geq 0$$

These two define the use of the 1st Quadrant only

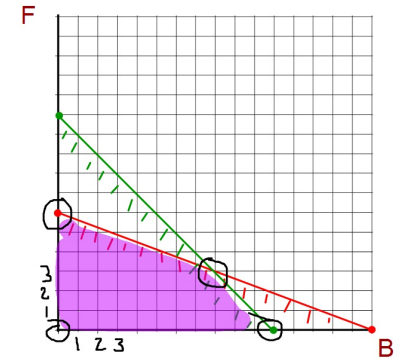
$$B + F \leq 11 \quad F \text{ \& B intercepts are both } 11$$

$$9B + 24F \leq 144$$

B-int = 16
 F-int = 6

c) State the coordinates of all four corners of the solution region (feasible region).

(0,0) (11,0) (8,3) (0,6)



8. If your players autograph the balls and you sell them you can get \$15 for each basketball and \$40 for each football. Write an equation that models the amount of money you can make by selling these balls.

$$\text{Income} = 15B + 40F$$

How many of each type of ball should be signed and sold in order to maximize the amount of money raised.

	15B + 40F
(0,0)	\$0
(11,0)	\$165
(8,3)	\$240
(0,6)	\$240

Since both of these result in \$240 you could choose either one. If there are other factors to consider it might help you decide if one is better than the other.