Sec 3-4: Linear Programming

A technique that identifies the maximum or minimum value of some quantity by meeting the restraints set forth in the problem.

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

- The farmer has up to 240 acres of land to use for these crops. $S + W \leq 240$
- The farmer has only enough seed for at most 180 acres of wheat. $W \leq 180$

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

$S \geq 0$

$W \geq 0$

S = # acres of Soybean

W = # acres of Wheat

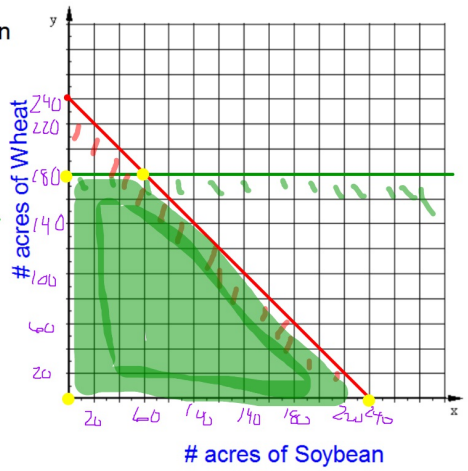
Constraints:

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

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

$S = 240 - W$

$W = 240$



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).

The four corners in the previous problem are :

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

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

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

150S + 200W = Income

This is called the Objective Function

(S,W)	150S + 200W
(240, 0)	36,000
(0,5)	0
(0, 180)	36,000
(60, 180)	45,000

the farmer should plant and sell 60 acres of Soybeans and 180 acres of Wheat in order to maximize his income.

A small business produces maple chairs and walnut chairs.

- The business can make at most 20 chairs per week
- Materials cost $100 per maple chair and $150 per walnut chair
- The budget for materials is $2400 per week

Write and graph a system of inequalities to model this situation.

$m + w \leq 20$ $100m + 150w \leq 2400$

$m \geq 0$ $w \geq 0$

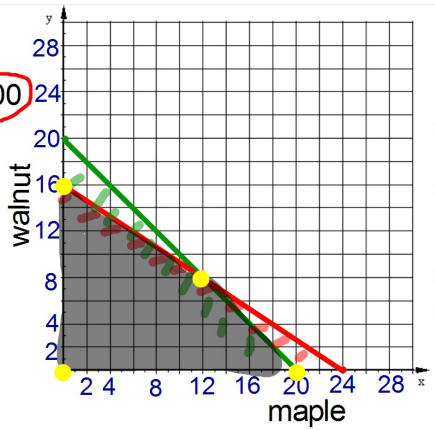
Number of chairs can't be negative

Constraints:

$100m + 150w \leq 2400$

$m + w \leq 20$

$m \geq 0$
$w \geq 0$ these two inequalities define the 1st Quadrant.



Corners to test:

(m,w)
(0,0)
(0,16)
(12,8)
(20,0)

Maple chairs sell for $400 each and Walnut chairs sell for $500 each. How many of each type should the business make in order to maximize their income?

(m,w)	400m + 500w
(0,0)	$0
(0,16)	$8000
(12,8)	$8800
(20,0)	$8000

Objective Function

400m + 500w = Income

the business should make and sell 12 maple chairs and 8 walnut chairs in order to maximize their income.