Sec 3-3: Graphing systems of inequalities

More than one inequality on the same graph.

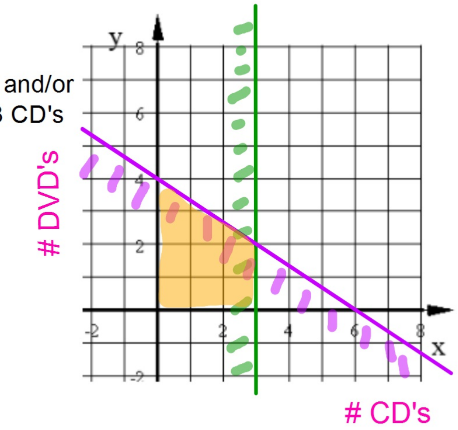
Solution to a system of Inequalities:

The region that is a solution to all inequalities at the same time.

The area that gets shaded multiple times, once for each inequality.

This is called the solution region or the feasible region.

The following inequalities model this situation:
You can only spend $48 on CD's and/or DVD's but will get no more than 3 CD's



C = # CD's

D = # DVD's

$C \geq 0$ $D \geq 0$ $C \leq 3$

$8C + 12D \leq 48$

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.

Using the CD and DVD example. Suppose I'm trying to maximize the amount of media I can get for my money.

Suppose CD's hold 300 minutes of music and DVD's hold 250 minutes of video. Find the combination of CD's and DVD's that maximize the amount of media yet meet all the constraints set forth already.

Objective Function:

$300C + 250D = T$

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).

Vertices of the feasible region	Objective Function 300C + 250D
(0,0)	0
(3,0)	900
(3,2)	1400
(0,4)	1000

If you buy 3 CD's and 2 DVD's you will maximize the amount of media for your purchase.

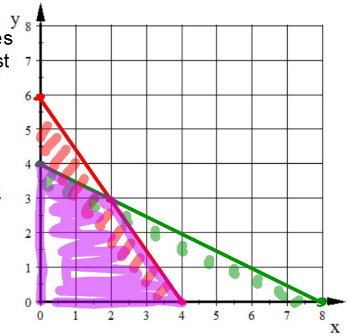
Graph this system of inequalities. Shade the solution region a different color than any of the inequalities.

$y \geq 0$
$x \geq 0$
this defines the 1st Quad

$y \leq \frac{-3}{2}x + 6$

$3x+6y \leq 24$

x-int = 8
y-int = 4



Corners of feasible region:
(0,4) (0,0) (4, 0) (2,3)

Given this Objective Function

$6x + 15y = P$

What values for x and y maximize this function?

x,y	6x+15
(0,4)	60
(0,0)	0
(4,0)	24
(2,3)	57

When x=0 and y=4 the equation 6x+15y=P is maximized.

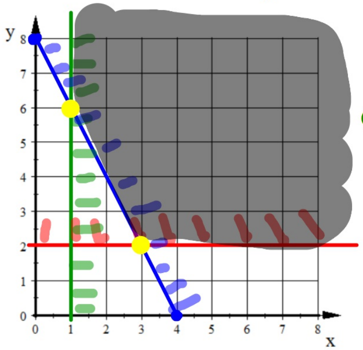
Graph this system of inequalities. Shade the solution region a different color than any of the inequalities.

$y \geq 2$

$x \geq 1$

$10x+5y \geq 40$

x-int = 4
y-int = 8



Corners of feasible region:

(3,2) and (1,6)

Given this Objective Function

$7x + 3y = P$

What values for x and y minimize this function?

(x,y)	7x + 3y = P
(3,2)	27
(1,6)	25

when x=3 and y=2 the equation 7x + 3y = p is minimized.

You want to sell some paintings and sculptures at a craft show. You spend 12 hours on each painting and 18 hours on each sculpture but only have 72 hours to work before the show. Each painting costs you $24 to make and each sculpture costs you $12 to make and you only have $96 to spend.

Write and graph a system of four inequalities to model the constraints in this situation.

p = # of paintings
s = # of sculptures

$12p + 18s \leq 72$ $24p + 12s \leq 96$

$s \geq 0$ $p \geq 0$

$12p + 18s \le 72$

S-INT = 4, P-INT = 6

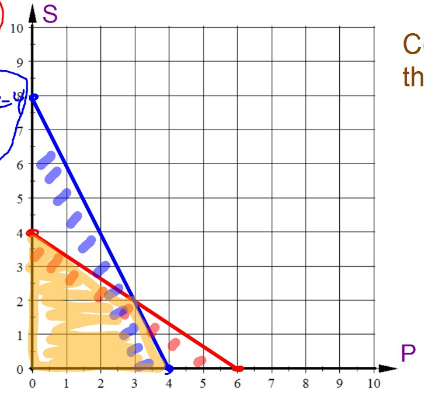
$24p + 12s \le 96$

P-INT = 4, S-INT = 8

$p \ge 0$

$s \ge 0$

Defines the 1ST Quadrant



Coordinates of the feasible region:

(0,0)
(4,0)
(3,2)
(0,4)

If you sell paintings for \$45 each and sculptures for \$70 each how many of each should you make and sell in order to maximize your income?

Write an Objective Function.

P = # paintings
S = # sculptures
I = Income

$45p + 70s = I$

How many of each type of artwork should the artist make in order to maximize income?

Objective Function:

$45p + 70s = I$

(p,s)	45p + 70s = I
(0,0)	0
(0,4)	280
(4,0)	180
(3,2)	275

the artist will maximize income of \$280 by making and selling 4 sculptures.

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.
- 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.

s = # acres of soybeans
w = # acres of wheat

$s + w \le 240$ $w \le 180$

$w \ge 0$ $s \ge 0$

S = # acres of Soybean

W = # acres of Wheat

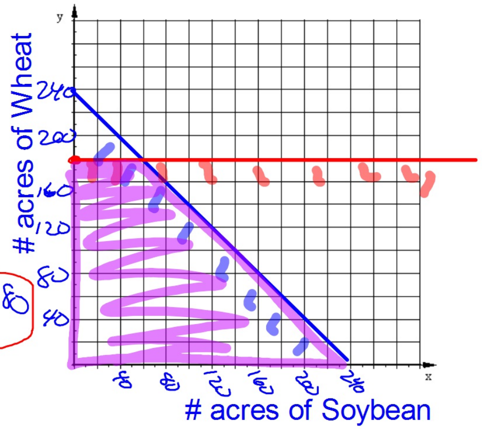
these define use of the 1st Quadrant only

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

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

S-int = 240
w-int = 240

w-int = 180



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

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

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

$150S + 200w = I$

(S,w)	150s + 200
(0,0)	0
(0,180)	36,000
(240,0)	36,000
(60,180)	45,000

The farmer will get a maximum income of $45,000 by planting 60 acres of soybeans and 180 acres of wheat.

Hwk #14 Sec 3-4

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Problems 2, 3, 5, 6, 11, 20
You will need some graph paper