10-11 Day 13

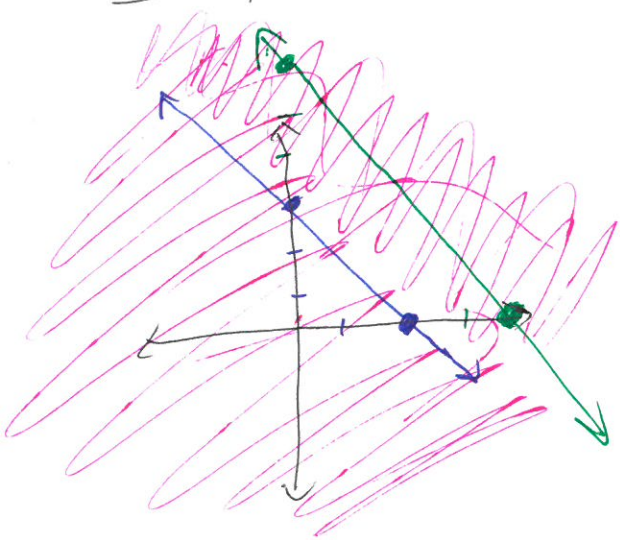
Warm up: Graph the feasible region for

$3x + 2y \leq 6$

$3x + 2y \geq 12$

1st plot the lines

- $3x + 2y = 6$
- $3x + 2y = 12$



$3x + 2y = 6$

$y = 0$

$3x = 6 \Rightarrow x = 2$

$x = 0$

$2y = 6 \Rightarrow y = 3$

$3x + 2y = 12$

$y = 0$

$3x = 12 \Rightarrow x = 4$

$x = 0$

$2y = 12$

Announcements:

- Test 2 is being pushed back
- Lowest test grade to be replaced with final
- Test 1 bluebooks are in my office

Last time 5.2 Linear Programming Graphically in 2 unknowns

The Fundamental Theorem of Linear Programming

- If there is an optimal solution at least one occurs at a corner point of the feasible region.

- If the feasible region is bounded, nonempty. Then there is always an optimal solution.

ex/ We want to maximize

$p = x + y$

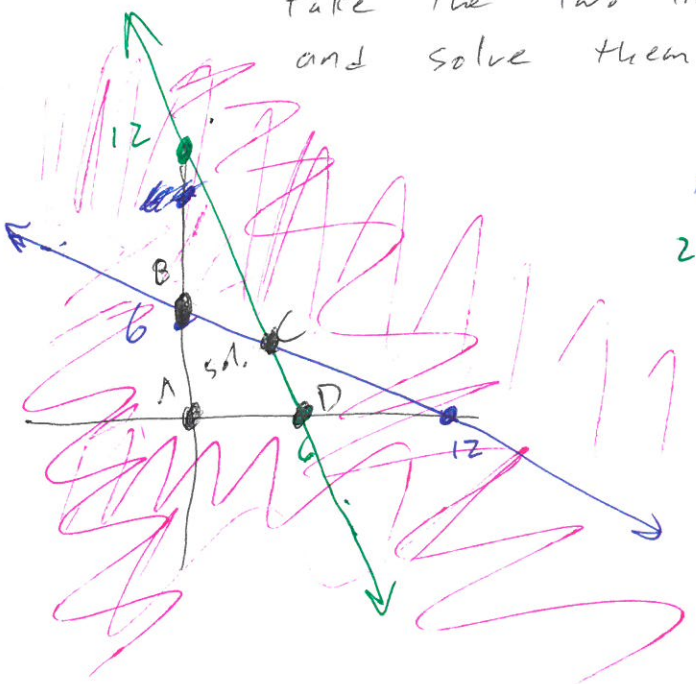
with constraints $x + 2y \leq 12$

$2x + y \leq 12$

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

Summary for finding optimal solutions of ~~unbounded~~ bounded feasible regions

1. Compute the coordinates of corner points (to find the corner of a feasible region → take the two lines that meet at that corner and solve them as a system of equations)



$x + 2y = 12$ (0, 6) (12, 0)

$2x + y = 12$ (0, 12) (6, 0)

A is (0, 0)

B is (0, 6)

C is (4, 4)

D is (6, 0)

Find C by solving the system

$x + 2y = 12$

$2x + y = 12$ ×2

$2x + 4y = 24$

$-\ 2x + y = 12$

$3y = 12$

$\Rightarrow y = 4$

plug into any equation

$2x + 4 = 12 \Rightarrow 2x = 8 \Rightarrow x = 4$

Step 2 Plug in corner points to objective function:

$P_1 = x + y$ $P_2 = 3x - y$

	P_1	P_2
A (0,0)	0	0
B (0,6)	6	-6
C (4,4)	(8)	8
D (6,0)	6	(18)

Step 3: find the corner which gives the largest/smallest value on our objective function.

ex/ How ling Low Egg Nog is making two kinds of Egg Nog this year.

Reduced Fat Egg Nog: uses 30 oz of milk, 2 oz of cream

Full fat Egg Nog: uses 20 oz of milk, 12 oz of cream

} per quart made

We have 30,000 oz of milk and 3,600 oz of cream

Make profit of 20¢ on a quart of reduced fat Egg Nog and 30¢ on a quart of full fat Egg Nog

How many quarts of each should they make to maximize profit?

• System of inequalities:

x := Reduced Fat (quarts of)

y := Full Fat (quarts of)

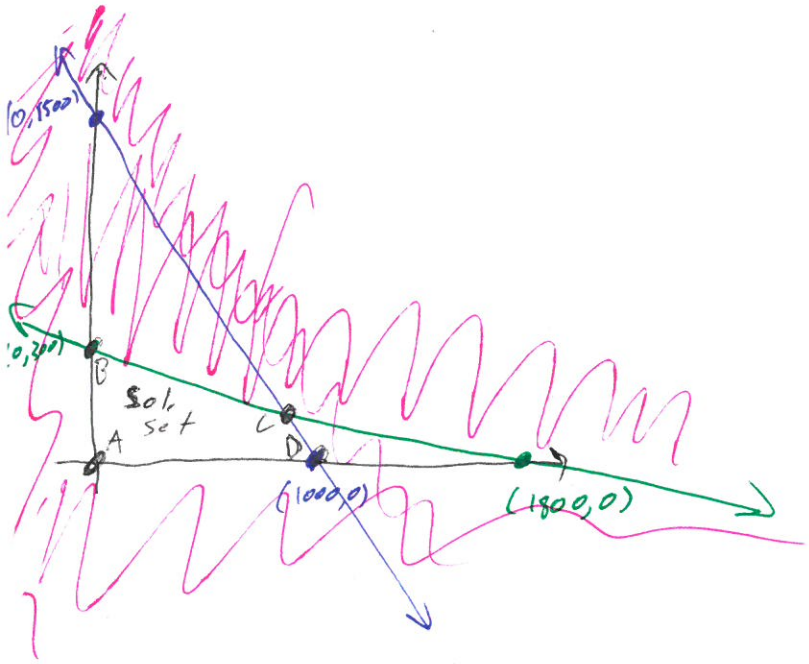
- $x \geq 0$
- $y \geq 0$
- $30x + 20y \leq 30{,}000$
- $2x + 12y \leq 3{,}600$

$.2x + .3y$ objective function

Note: to make the problem easier simplify the inequalities

$3x + 2y \leq 3{,}000$

$x + 6y \leq 1800$



(0, 1,500) (0, 300)

(1000, 0) (1800, 0)

A (0,0)
B (0, 300)
C (900, 150)
D (1000, 0)

$3x + 2y = 3000$

$x + 6y = 1800$

$9x + 6y = 9000$

$-\ x + 6y = 1800$

$8x = 7200$

$x = 900$

$y = 150$

	$.2x + .3y$
A (0,0)	\$ 0
B (0,300)	\$ 90
C (900,150)	\$ 225
D (1000,0)	\$ 200

what if the objective function was

$.4x + .2y$?

	~~$.4x + .2y$~~
A (0,0)	$0
B (0,300)	$60
C (900, 150)	$390
D (1000, 0)	$400

~~First~~

First solution uses <u>all</u> the milk and cream

second solution <u>does not</u> use all the resources.