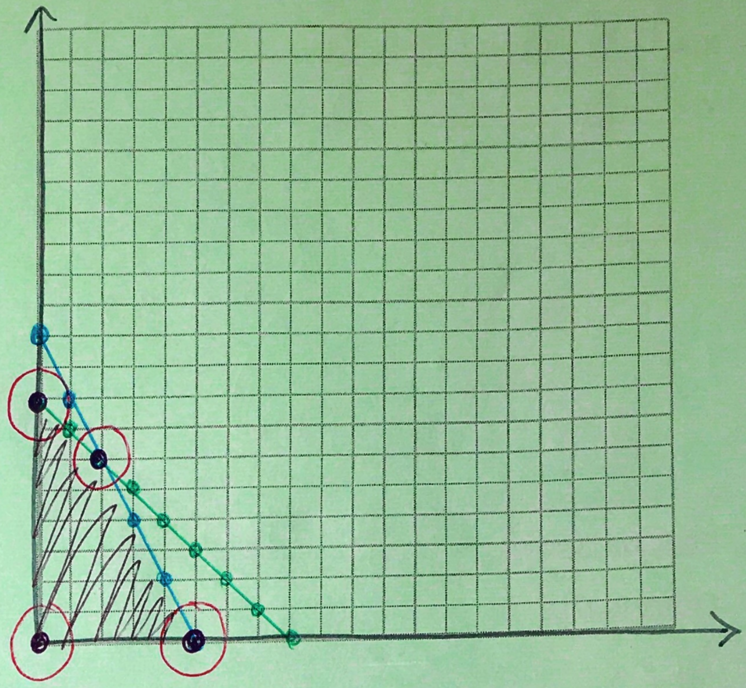
Algebra 2
1.4 – Linear Programming Practice 1

Name: Key

Date: ________ Per: ________

every

1) Farmer Joe can plant up to 8 acres of land with wheat and barley. He can earn $5000 for every acre of wheat and $3000 for [every] acre of barley. His use of necessary pesticide is limited by federal regulations to 10 gallons for his entire 8 acres. Wheat requires 2 gallons of pesticide for every acre planted and barley requires just 1 gallon per acre. How many acres of each crop should Farmer Joe plant to maximize his profit?



Define the variables:

X = # of acres of wheat

Y = # of acres of barley

Constraints: $x \geq 0$

$y \geq 0$

$2x + y \leq 10$ → $y \leq -2x + 10$

$x + y \leq 8$ → $y \leq -x + 8$

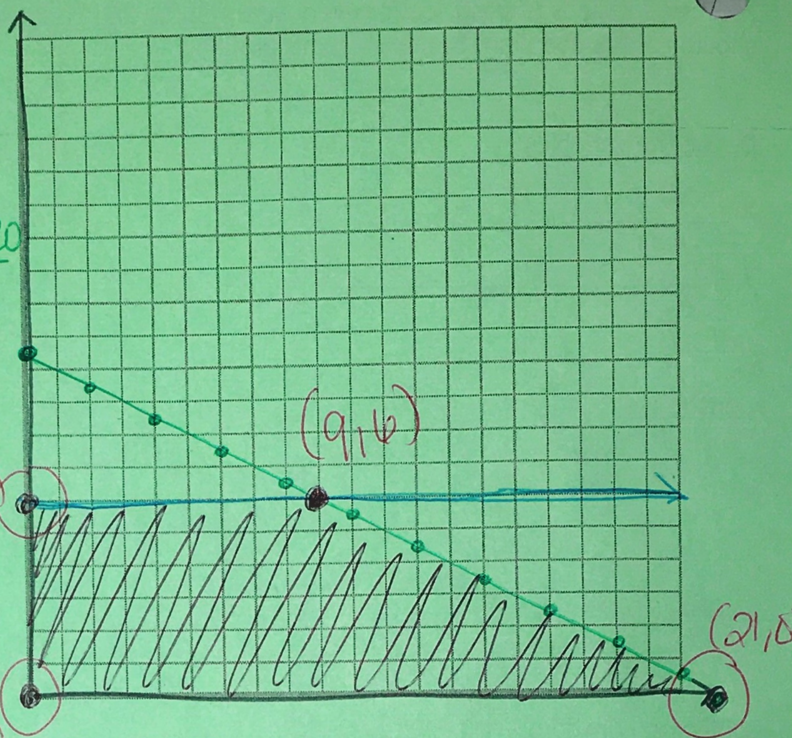
Objective Function: $f(x,y) = 5000x + 3000y$

Critical Points:

(0,0)	(0,8)	(2,6)	(5,0)
5000(0) + 3000(0)	5000(0) + 3000(8)	5000(2) + 3000(6)	5000(5) + 3000(0)
= 0 + 0	= 0 + 24000	= 10,000 + 18000	25000 + 0
= 0	= 24000	$\boxed{= 28{,}000}$	= 25000

Conclusion: 2 acres of wheat + 6 acres of barley will maximize Joe's profit.

2) As a receptionist for a veterinarian, one of Mrs. Barkman's tasks is to schedule appointments. She allots 20 minutes for a routine office visit and 40 minutes for a surgery. The veterinarian cannot do more than 6 surgeries per day. The office has 7 hours available for appointments. If an office visit costs $55 and most surgeries cost $125, find a combination of office visits and surgeries that will maximize the income the veterinarian practice receives per day.



Define the variables:

X = # of office visits

Y = # of surgeries

Constraints:

$x \geq 0$

$y \geq 0$

$y \leq 6$

$20x + 40y \leq 420$

$\frac{40y}{40} \leq \frac{-20x}{40} + \frac{420}{40}$

$y \leq -\frac{1}{2}x + 10.5$

Objective Function: $f(x,y) = 55x + 125y$

Critical Points:

(0,0)
$55(0) + 125(0) = 0$

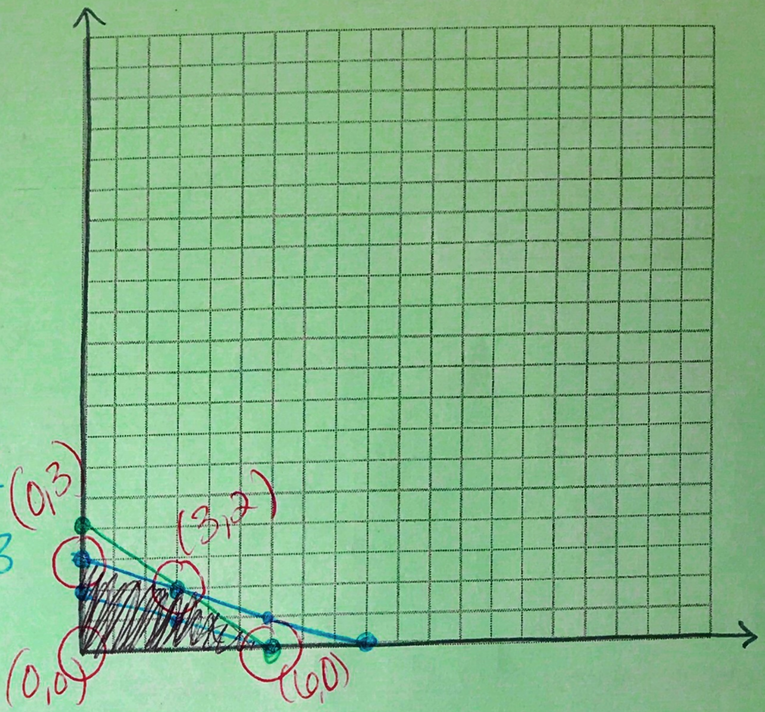
(0,6)
$55(0) + 125(6) = 750$

(9,6)
$55(9) + 125(6) = 1245$

(21,0)
$55(21) + 125(0) = 1155$

Conclusion: Mrs. Barkman should schedule 9 office visits & 6 surgeries to maximize her income to $1245.

Bob the Builder has upgraded to the big league and now builds tool sheds. He uses 10 sheets of dry wall and 15 studs for a small shed and 15 sheets of dry wall and 45 studs for a large shed. He has available 60 sheets of dry wall and 135 studs. If Bob makes \$390 profit on a small shed and \$520 on a large shed, how many of each type of building should Bob build to maximize his profit?



Define the variables:

X = # of small sheds

Y = # of large sheds

Constraints:

$x \geq 0$

$y \geq 0$

$10x + 15y \leq 60$

$15x + 45y \leq 135$

$\frac{15y}{15} \leq \frac{-10x}{15} \frac{+60}{15}$

$y \leq -\frac{2}{3}x + 4$

$\frac{45y}{45} \leq \frac{-15x}{45} \frac{+135}{45}$

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

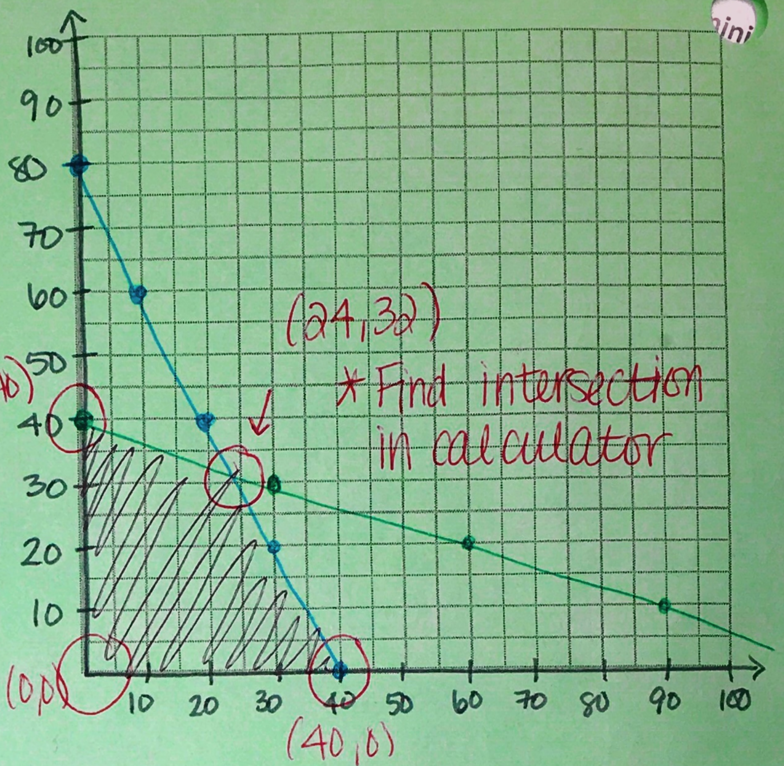
Objective Function: $f(x,y) = 390x + 520y$

Critical Points:

(0,0)	(0,3)	(3,2)	(6,0)
390(0)+520(0)	390(0)+520(3)	390(3)+520(2)	390(6)+520(0)
=0	=1560	=2210	=2340

Conclusion: Bob needs to build 6 small sheds and 0 large sheds to maximize his profit.

4) An agriculture company has 80 tons of type I fertilizer and 120 tons of type II fertilizer. The company mixes these fertilizers into two products. Product X requires 2 parts of type I and 1 part of type II fertilizers. Product Y requires 1 part of type I and 3 parts of type II fertilizers. If each product sells for $2000, what is the maximum revenue and how many of each product should be made and sold to maximize revenue?



Define the variables:

X = # of Product X

Y = # of Product Y

Constraints:

$x \geq 0$

$y \geq 0$

$2x + y \leq 80$ → $y \leq -2x + 80$

$x + 3y \leq 120$ → $\frac{3y}{3} \leq \frac{-x}{3} + \frac{120}{3}$

$y \leq -\frac{1}{3}x + 40$

Objective Function: $f(x,y) = 2000x + 2000y$

Critical Points:

(0,0)	(0,40)	(24,32)	(40,0)
$2000(0) + 2000(0)$	$2000(0) + 2000(40)$	$2000(24) + 2000(32)$	$2000(40) + 2000(0)$
$= 0$	$= 80{,}000$	$= 112{,}000$	$= 80{,}000$

Conclusion: The company should make 24 of product X + 32 of product y.