Chapter 5- Systems of Linear Inequalities

5.5 Optimization Problems II: Exploring Solutions

GOAL: *Explore the feasible region of a system of linear inequalities.*

Remember from Optimization Part 1:

o An optimization problem is a problem in which we find the __min__ or __max__ value of functions.

o The system of functions consists of linear inequalities creating an overlapping area of __feasability.__.

Our steps for Optimization look like this:

1) Identify what to __optimize__.

2) Define the __variables__ and restrictions.

3) Write a system of __inequalities__ to describe the constraints (possible values) and graph them.

4) Write an __Objective__ function for the optimization (equation to determine the min/max).

Realize that there are always __multiple__ solutions within the feasibility region. Our goal is to identify the __best__ solution (min/max) which is always found at points of __intersections__.

More Practice!

A company does custom paint jobs on cars and trucks. Due to the size of the workshop, the company can paint a maximum of 8 cars and a maximum of 5 trucks in one day. The total output for the shop cannot exceed 10 vehicles (total) in one day due to time. The company earns $400 for a truck paint job and $250 for a car paint job. How many of each should they book to earn the greatest profit in one day?

What are the variables? Represent them with a letter.

x - Cars

y - Trucks

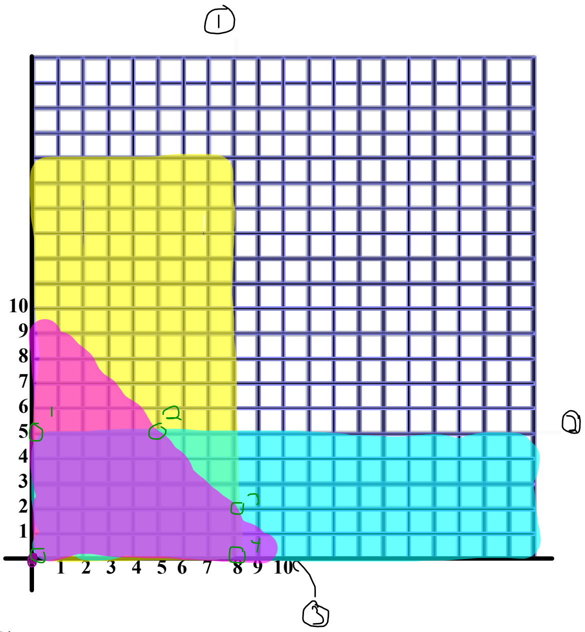
Write inequalities using these variables and info from the question.

1) $x \leq 8$

2) $y \leq 5$

3) $x + y \leq 10$

(0, 0)



Graph and determine the Objective Equation to solve for the max/min.

What are we trying to optimize? Maximize profit (P)

P = $250x + $400y

*Where do our optimized solutions appear in the feasible region (overlapped shading) on our graph?

At the intersections

Therefore, our possible optimized solutions are:

1) ~~(0,5)~~

2) (5,5): P = $250(5) + $400(5) = $3250

3) (8,2): P = $250(8) + $400(2) = $2800

4) ~~(8,0)~~

* This means that the solution in the feasible range which gives the Maximum profit would be to paint 5 cars and 5 trucks making them $3250

A BC farmer wants to plant a combination of apple and pear trees that will maximize revenue.

- She wants to plant no more than 500 trees altogether.
- She wants to plant at least four times as many apple as pear trees
- The yield per apple tree is 4 bushels ($8.50 per bushel), and the yield per pear tree is 3 bushels (9.50 per bushel).

$34 → 4×8.50

→ 3×9.50 = 28.50

a - apples
p - pears

① $a + p \leq 500$

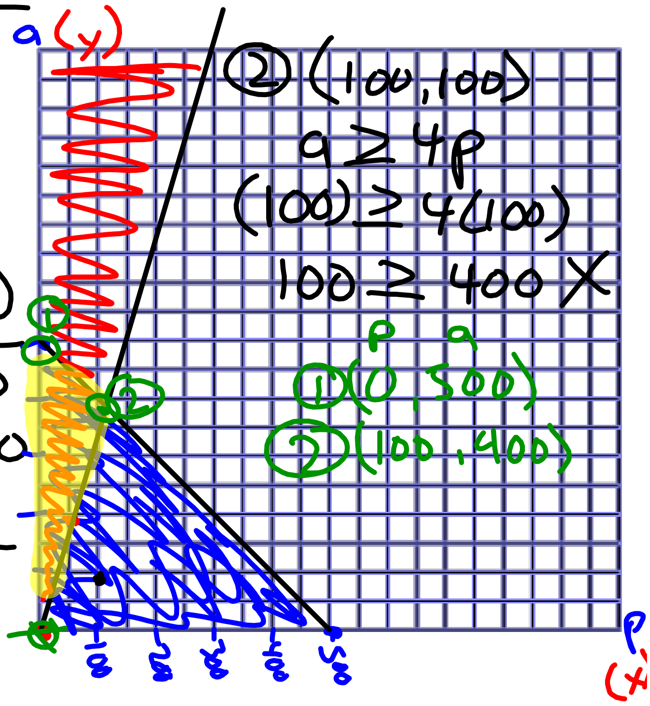
② $a \geq 4p$

① $a + p = 500$

a int (p=0)	p int (a=0)
$a + (0) = 500$	$p = 500$
$a = 500$	$p = 500$

$a = 4p$

$y = 4x + 0$ (slope $\frac{4}{1}$)



$R = 34a + 28.50p$

① (0,500)

$R = \$34(500) + \$28.50(0)$ *

$R = \$17,000$

② (100,400)

$R = \$34(400) + 28.50(100)$

$R = \$13,600 + \$2850$

$R = \$16,450$

Plant 500 apple trees and 0 pear trees to maximize revenue.

Assignment: 1) p 249: #6, 7