5.3. Linear Programming in 2 Dimensions

Monday, October 16, 2017 12:31 PM

Goal: Solve linear programming problems in 2 Dimensions.

	Capacity	Crew required	# of trucks available
A	300	3	40
B	500	2	60

2 types of trucks: A and B

Exactly 180 truck operators.

How many trucks of each type should be used to maximize the capacity?

x: truck A. y: truck B.

Capacity = $300x + 500y$.

$3x + 2y \leq 180$

$x \leq 40$; $y \leq 60$

$x \geq 0$; $y \geq 0$

→ Maximize: $C = 300x + 500y$

Subject to:

$3x + 2y \leq 180$

$x \leq 40$; $y \leq 60$

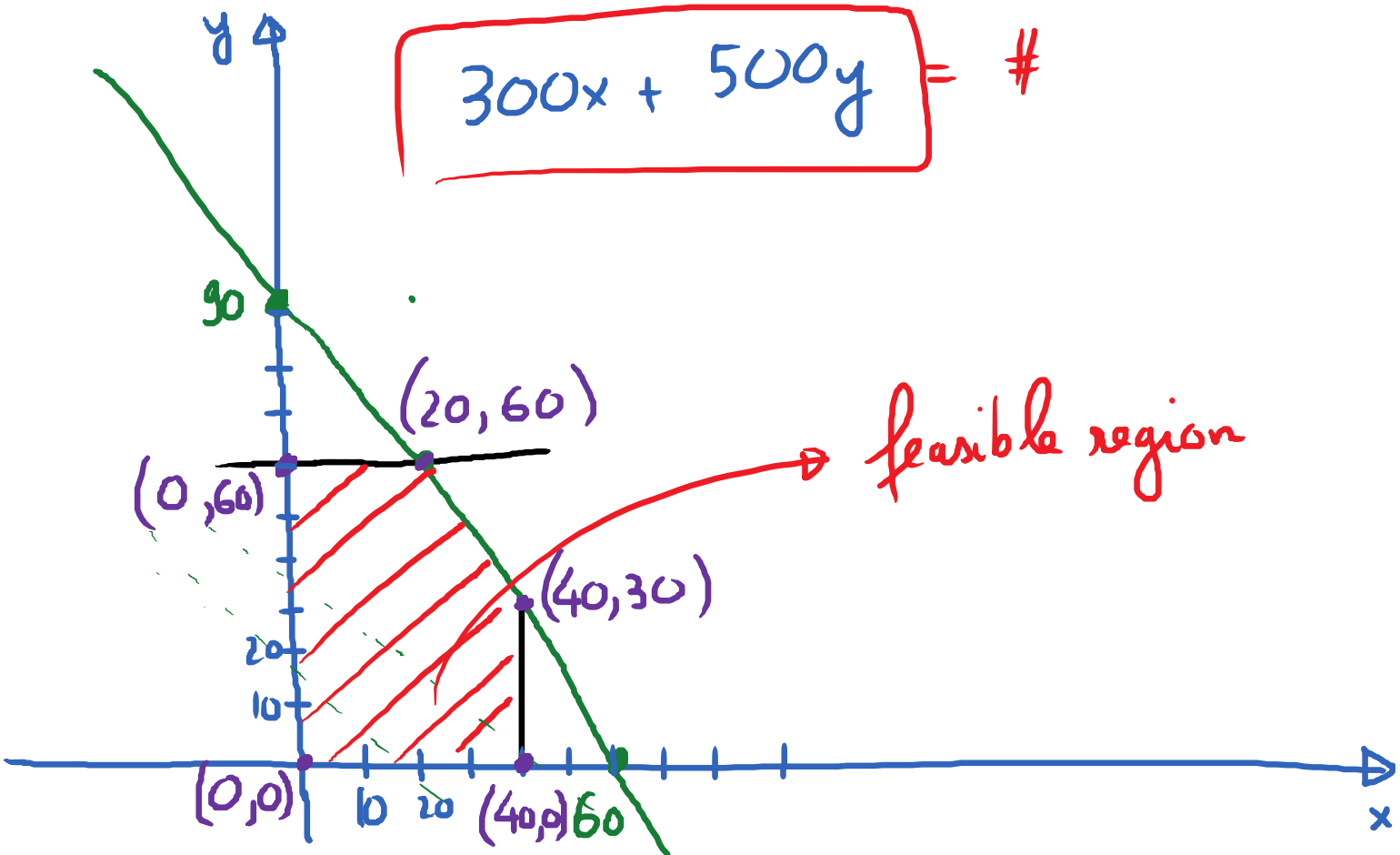
$x \geq 0$; $y \geq 0$

$3x + 2y \leq 180$

$2y \leq -3x + 180$

$y \leq -\frac{3}{2}x + 90$

$300x + 500y = \#$



Corner Points	$C = 300x + 500y$
(0,0)	0
(0,60)	30000
(40,0)	12000
(40,30)	27000
(20,60)	36 000

Eg: Manufacturer.

2 types of product
- A
  - 8 hours to design
  - 4 hours to finish
- B
  - 8 hours to design
  - 12 hours to finish.

Total # of hours for product design is at most 160.

Total # of hours for product finishing is at most 180.

# of product A is no more than 15

Each product A sells for: $5

Each product B sells for: $10.

x: # of product A, y # of product B.

Q: Find x, y such that profit is maximized.

Profit: $P = 5x + 10y$.

Input:

$8x + 8y \leq 160$

$4x + 12y \leq 180$

$x \leq 15$

$x \geq 0 \; ; \; y \geq 0$

Constraints

$$\begin{pmatrix} 8 & 8 \\ 4 & 12 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 160 \\ 180 \end{pmatrix}$$

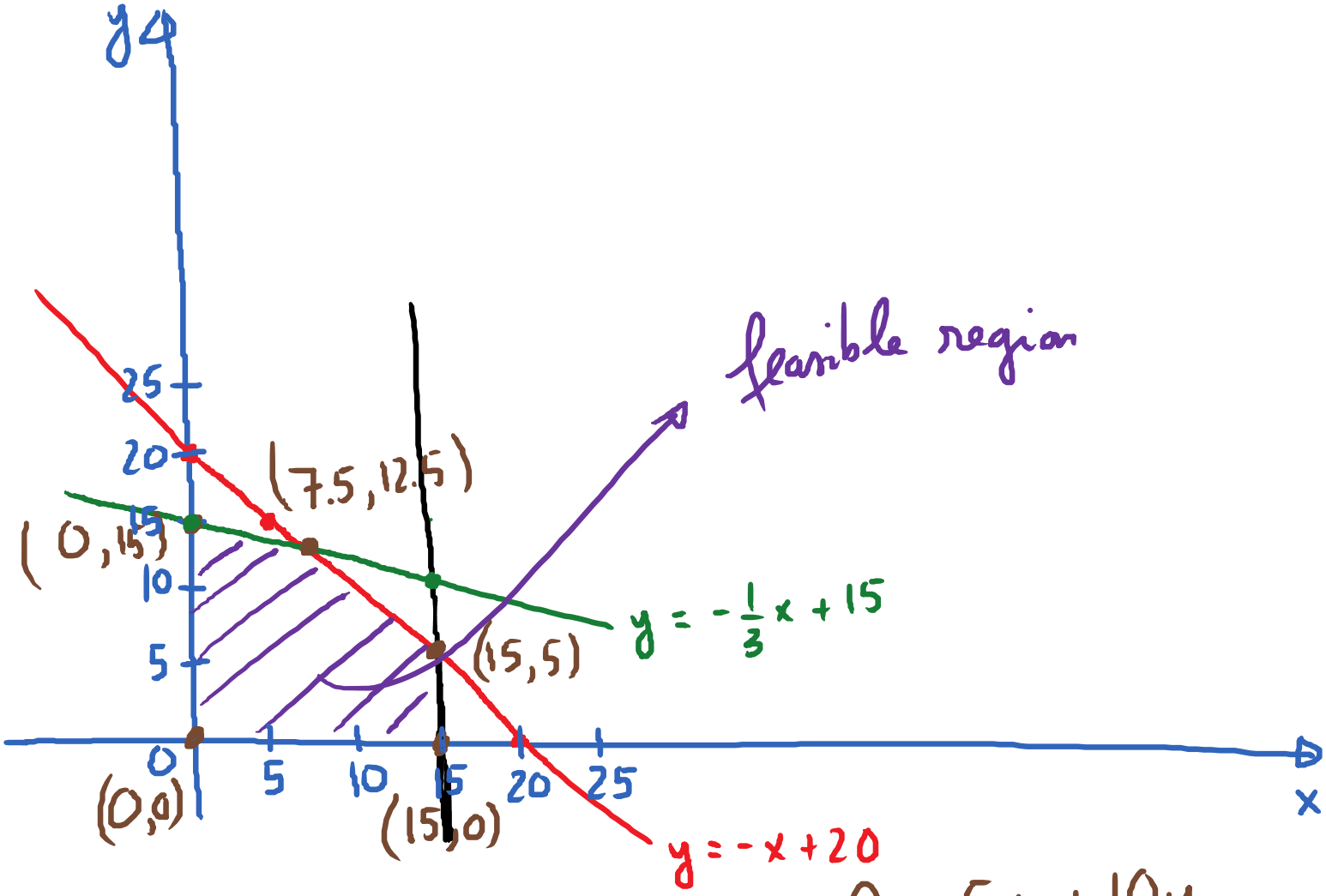
Maximize $P = 5x + 10y$

$8y \leq -8x + 160$

$y \leq -x + 20$

$12y \leq -4x + 180$

$y \leq -\frac{1}{3}x + 15$



Maximize $P = 5x + 10y$

Corner points	
(0,0)	0
(15,0)	75
(0,15)	150
(15,5)	125
(7.5,12.5)	162.5

max

Round down:
(7,12)