5.3. Linear Programming in 2 Dimensions

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<u>Goal:</u> Solve linear programming problems in 2 Dimensions.

<u>E.g.</u> Small truck company.

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

Exactly 180 truck operators.

x : # truck A to utilize

y : # truck B to utilize

How many trucks A and trucks B such that the capacity is maximized?

Common sense: $x = 20$; $y = 60$

$$\text{Capacity} = 300x + 500y.$$

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

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

$3x + 2y \leq 180$

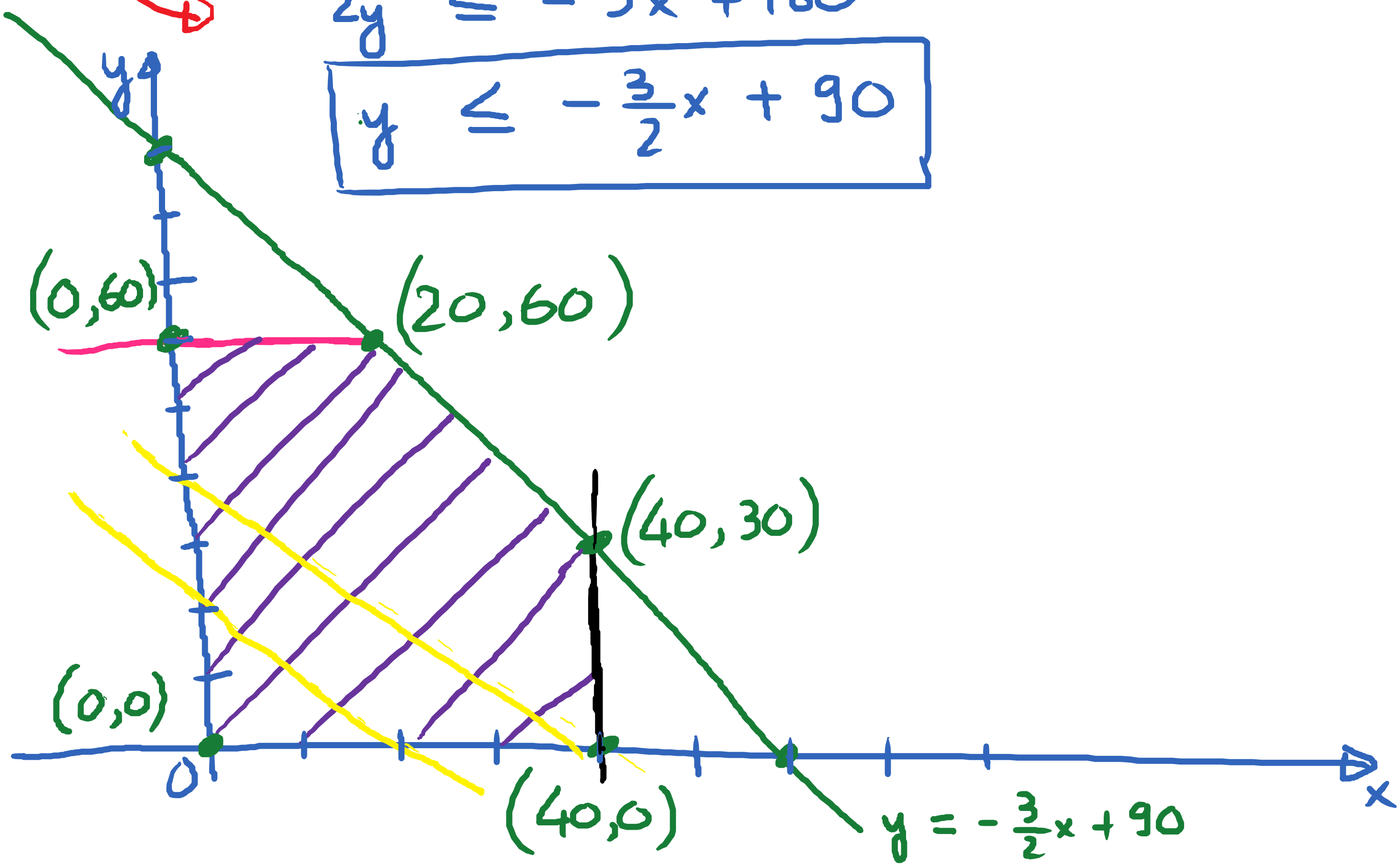
Constraints

Find x, y such that $C = 300x + 500y$ is maximum subject to these constraints.

* Step 1: Find the feasible region for the constraints

$2y \leq -3x + 180$

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



Corner points	$C = 300x + 500y$
(0,0)	0
(40,0)	12000
(0,60)	30000
(40,30)	27000
(20,60)	36000

→ maximum.

Solution $x = 20$; $y = 60$.

1. The expression that describes the quantity you want to optimize.
2. Constraints (System of inequalities)
3. Using 2, find feasible region, find corner points.
4. Plug corner points into expression in 1, find the optimizer.

E.g. 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 hours

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

# of product A is no more than 15.

Each product A sells for $500

Each product B sells for $1000

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

Find x and y such that profit is maximized.

1. Profit: $P = 500x + 1000y$

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(2) $8x + 8y \le 160$

$4x + 12y \le 180$

$x \ge 0 ; \ y \ge 0$

$x \le 15$

(3) Draw the feasible region and find corner points

Did this last time.

(4)

Corner Points	$P = 500x + 1000y$
(0,0) →	0
(15,0) →	7500
(0,15) →	15000
(15,5) →	12500
(7.5,12.5) →	16250

Round down

$x = 7$

$y = 12$

(want to be in feasible region)

Max Profit = $500 \cdot 7 + 12 \cdot 1000$

$= 15500$