

OPTIMIZATION (Linear Programming)

Goal:

- to understand the basic framework of optimization problems
- to translate constraints into linear inequalities
- to graph linear inequalities

During the summer, Adel grows strawberries on his farm in the St. Laurent Lowlands. His wife Denise makes jam that she sells in her general store. She fills 400 ml jars and 500 ml jars.

- Every week she uses a maximum of 30 litres of jam
- She wants to produce at least 50 jars per week
- She also wants to produce, weekly, at least 20 but at most forty 500 ml jars
- Also, she wants to produce, weekly, at least twenty 400 ml jars

How many jars of each size must she produce weekly in order to maximize her profit if she sells each 400 ml jar for \$7 and each 500 ml jar for \$9?

.

① Translate constraints into linear inequalities:

x : # of 400-ml jars / week

y : # of 500-ml jars / week

① $x + y \geq 50$

② $y \geq 20$

③ $y \leq 40$

④ $x \geq 20$

⑤ $400x + 500y \leq 30\,000$

System of
inequalities

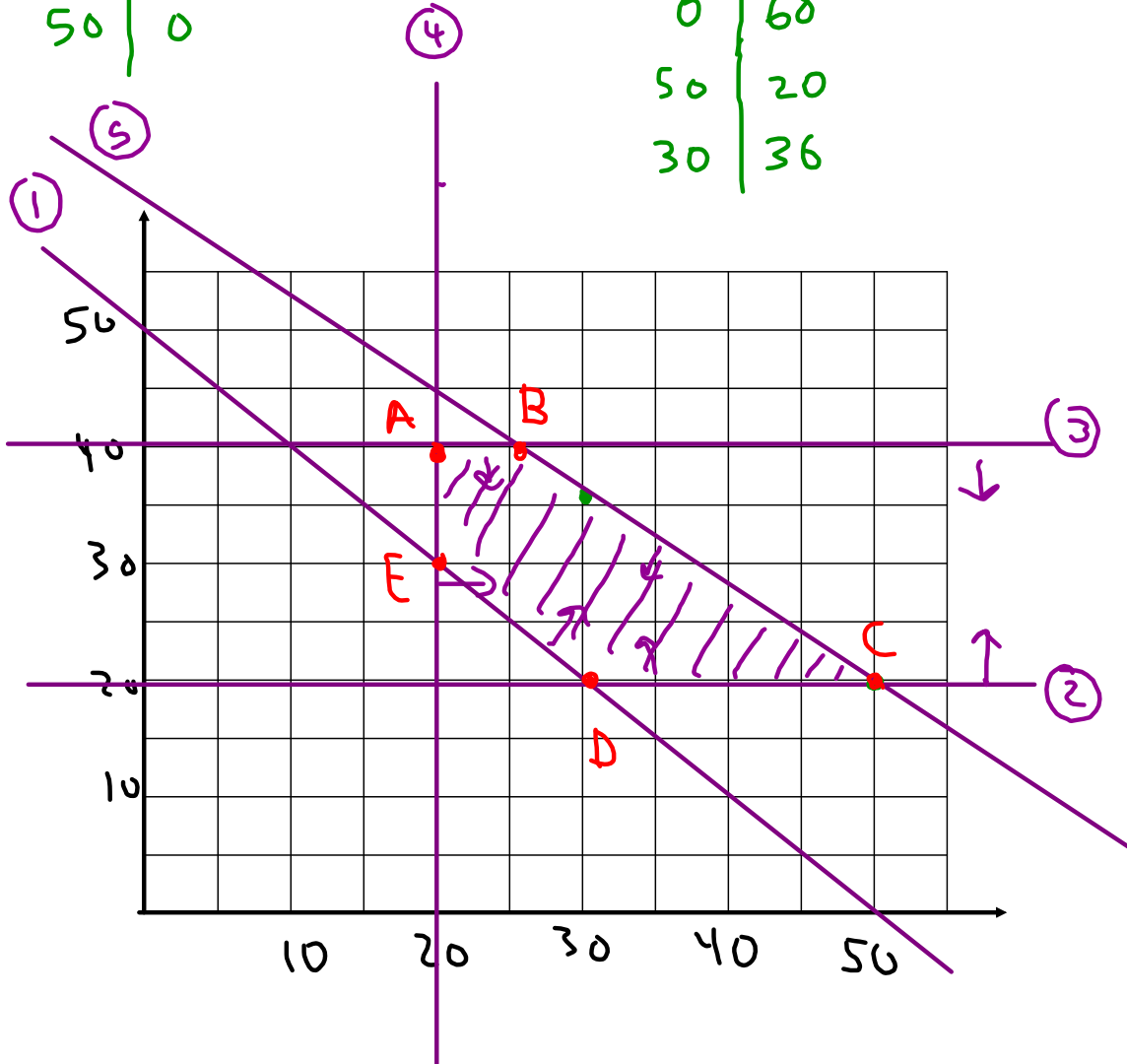
② Graph inequalities

$$x + y = 50$$

x	y
0	50
50	0

$$400x + 500y = 30\ 000$$

x	y
75	0
0	60
50	20
30	36



Polygon ABCDE is called the

POLYGON OF CONSTRAINTS

③ Find coordinates of vertices on Polygon of Constraints

$$A(20, 40)$$

$$B(25, 40)$$

$$C(50, 20)$$

$$D(30, 20)$$

$$E(20, 30)$$

④ or ① Write function to be optimized
(objective function)

$$R = 7x + 9y$$

⑤ Test vertices in objective function to find max/min.

$$B(25, 40) \quad R = 7(25) + 9(40) = 535 \leftarrow \text{MAX.}$$

$$C(50, 20) \quad R = 7(50) + 9(20) = 530$$

⑥ Interpret result to find optimal sol'n.

25 400-ml jars + 40 500-ml jars

will max. revenues each week