LINEAR PROGRAMMING

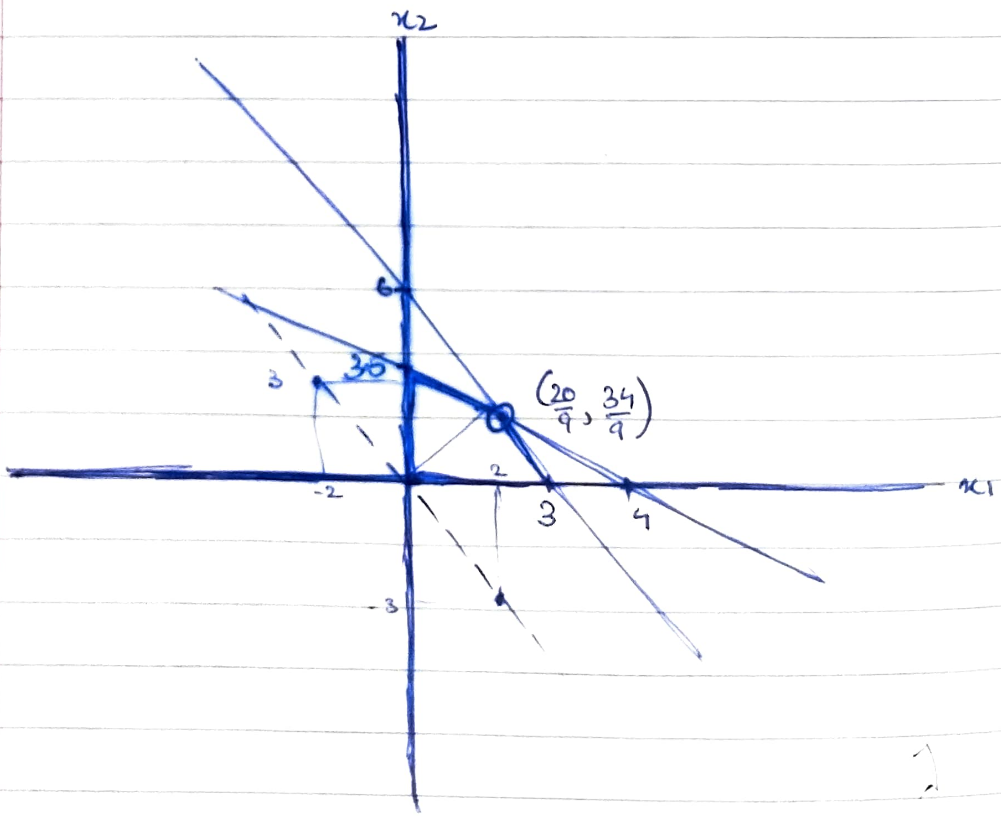
$\max_{x_1, x_2} \quad 3x_1 + 2x_2$ ← objective function

subject to $\quad 2x_1 + x_2 \leq 6$

$7x_1 + 8x_2 \leq 28$ } constraints

$x_1 \geq 0 \quad x_2 \geq 0 \qquad x_1, x_2 \in \mathbb{R}$

- feasible region
  solution space
- feasible solution
  (any pt. in feasible region)
- optimal solution.



$$2x_1 + x_2 = 6 \quad \times 8 \qquad 16x_1 + 8x_2 = 48$$

$$7x_1 + 8x_2 = 28 \quad \times 1 \qquad 7x_1 + 8x_2 = 28$$

$$9x_1 = 20$$

$$x_1 = \frac{20}{9}$$

$$x_2 = 6 - 2x_1 = 6 - \frac{20}{9} = \frac{54 - 20}{9} = \frac{34}{9}$$

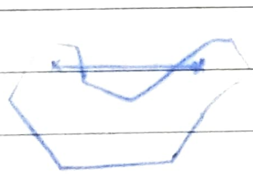
n variables

m constraints

$$\max_x \; Z = c^T x \qquad c : n \times 1$$

subject to $\quad Ax \le b \qquad x : n \times 1$

$$x \geq 0 \qquad A : m \times n$$



$$b : m \times 1$$

① for minimization problem:

$$\min_x \; Z = c^T x = \max_x \; -c^T x$$

② one of the constraints is $|x_i| < 3$

$x_i < 3$ and $x_i > -3$

$3 - \varepsilon \qquad x_i \geq -3 + \varepsilon$

$3 \times \frac{20}{9} + 2 \times \frac{34}{9}$

$\frac{68 + 60}{9}$

$\frac{128}{9}$

③ what if one of the constraint is $|x_i| = 3$

$x_i = +3$ or $x_i = -3$

$x_i \geq 3$ or $x_i \geq -3$

$x_i \leq 3$ $x_i \leq -3$

maybe we have to solve it as 2 separate linear programming problems,

④ problem with added constraint of $x \in Z$ (integer programming).

convex polygon non-convex polygon