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Quiz#5 EE320 Semester 1/2019: Answer the question in the area provided.

A firm produces two different kinds of commodity, namely A and B. The daily cost of producing x units of A and y units of B is

$$C(x,y) = 2x^2 - 4xy + 4y^2 - 40x - 20y + 14$$

Suppose that the firm sells all its output at a price per unit of \$24 for A and \$12 for B. Find the daily production levels x and y that maximize profit. Confirm your result with second-order conditions test.

$\pi = (24x + 12y) - (2x^2 - 4xy + 4y^2 - 40x - 20y + 14)$

FOC $\pi_x = \pi_y = 0$

$\pi_x = 24 - (4x - 4y - 40) = 0$

$\pi_y = 12 - (-4x + 8y - 20) = 0$

$4x - 4y = 64 \quad (1)$

$-4x + 8y = 32 \quad (2)$

$(1)+(2) \Rightarrow 4y = 96 \Rightarrow y^* = 24$ units.

$4x^* = 64 + 4(24)$

$= 64 + 96 = 160$

$x^* = 40$ units

SOC $H = \begin{bmatrix} \pi_{xx} & \pi_{xy} \\ \pi_{yx} & \pi_{yy} \end{bmatrix}$

$= \begin{bmatrix} -4 & +4 \\ +4 & -8 \end{bmatrix}$

$|H_1| = -4 < 0$

$|H_2| = 32 - 16 = 16 > 0$

(i) H is negative definite at $(x^*, y^*) \Rightarrow d^2\pi < 0$

(ii) Since H is always negative definite $\Rightarrow d^2\pi < 0$ $\forall x, y$

$\therefore (x^*, y^*)$ is also global maximum solution.