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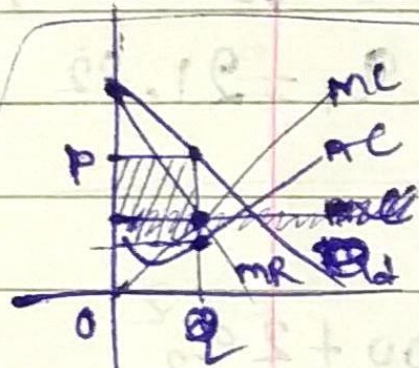
Q1

$$C = 200 + 2Q^2$$

$$AC = \frac{200}{Q} + 2Q$$

$$Q_d = 240 - P \therefore P = 240 - Q_d$$

(a) $\pi = R - C$ & for $\max^m \pi \rightarrow \frac{d\pi}{dQ} = 0 = MR - MC$



$$MR = P + Q \frac{dP}{dQ}$$

$$= (240 - Q) + Q(-1)$$

$$= 240 - 2Q$$

$$MC = 4Q$$

$$240 - 2Q = 4Q$$

$$6Q = 240 \quad Q = 40$$

$$MR = \frac{dR}{dQ} = \frac{d(PQ)}{dQ}$$

$$= \frac{d(240Q - Q^2)}{dQ}$$

$$= 240 - 2Q$$

$$\therefore P = 240 - 40 = 200$$

$$AC = \frac{200}{40} + 2(40) = 85$$

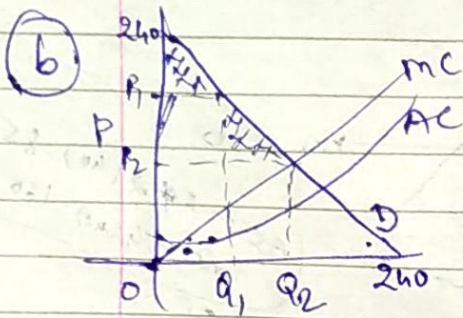
$$\therefore \pi = (200 \times 40) - (85 \times 40)$$

$$= 115 \times 40$$

$$\pi = 4600$$

$$(2) \quad \frac{d\pi}{dQ} = 0 \Rightarrow C = 200 + 2(40)^2 = 3400$$

\therefore eqn ①, ②, ③ \Rightarrow Answers.



$$\pi = R - C$$

$$\frac{d\pi}{dq}$$

$$C = 200 + 2q_2$$

$$q = 240 - p$$

$$p = 240 - q$$

$$\pi = (p_1 \times q_1) + (p_2 \times (q_2 - q_1)) - C$$

①

$$\pi = (240 - q_1)q_1 + (240 - q_2)(q_2 - q_1) - (200 + 2q_2^2)$$

$$\pi = 240q_1 - q_1^2 + 240q_2 - 240q_1 - q_2^2 + q_1q_2 - 200 - 2q_2^2$$

$$\therefore \pi = -q_1^2 + 240q_2 + q_1q_2 - 200 - 3q_2^2$$

$$\frac{\partial \pi}{\partial q_1} = -2q_1 + q_2 = 0$$

$$\text{and } \frac{\partial \pi}{\partial q_2} = 240 + q_1 - 6q_2 = 0$$

$$-2q_1 + q_2 = 0$$

$$2q_1 - q_2 = 480$$

$$+11q_2 = +480$$

$$\therefore q_2 = 43.64$$

$$\therefore q_1 = 21.82$$

$$\therefore q_1 = 21.82; q_2 = 43.64$$

$$\therefore P_1 = 240 - 21.82 = 218.18$$

$$\therefore P_2 = 240 - 43.64 = 196.36$$

$$\therefore \text{from eqn ①, ②, ③, ④, ⑤}$$

$$\pi = 5036.36$$

$$\therefore C = 200 + 2q_2^2$$

$$= 4008.899$$

$$C = 4008.9$$

②

$$\therefore \text{Consumer surplus: } CS_b = \left[\frac{1}{2} q_1 \times (240 - 218.18) \right] + \left[\frac{1}{2} \times (q_2 - q_1) (P_1 - P_2) \right]$$

$$= 238.06 + 238.06$$

$$CS_b = 476.12$$

→ Cons. surplus in part-a : $CS_a = \frac{1}{2} \times (240 - 200)(90 - 0)$

$$\therefore CS_a = 800$$

∴ ^{Qty. Item} changes of

part-a (vs.) part-b	part-a (single price)	part-b (Intermediate Price change)	difference of (part-b)-(part-a)
Profit	4600	5036.36	436.36
Consumer Surplus	800	476.12	-323.88.

∴ With intermediate price change profit increases by 436.36 units and consumer surplus decreases by 323.88 units.

(C) Perfect price discrimination:

$$C = 200 + 2Q^2$$

$$P = 240 - Q = MR$$

$$\text{or } MC = 4Q$$

∴ for max. profit,

$$MR = MC$$

$$240 - Q = 4Q$$

$$\therefore \text{Quantity: } [Q = 48] \text{ \& } [P = 240 - 48 = 192]$$

$$\begin{aligned} \therefore \text{Profit} &= (\text{Area under } MR_d \text{ curve from } q=0 \text{ to } q=48) - C \\ &= \left(\frac{1}{2} \times (48 - 0) \times (240 - 192) \right) + (192 \times 48) - (200 + 2(48)^2) \\ &= 1152 + 9216 - 4808 \end{aligned}$$

$$\therefore [\text{Profit} = 5560 \text{ units}] - (2)$$

→ And here, all consumer surplus is converted into producer surplus

$$\therefore [\text{Consumer surplus} = 0] - (3) \therefore \text{eqn (1), (2), (3) are answers.}$$

