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I, bearing Registration Number 106119100, agree and acknowledge that:

1. The assessment was answered by me as per the instructions applicable to each assessment, and that I have not resorted to any unfair means to deliberately improve my performance.

2. I have neither impersonated anyone, nor have I been impersonated by any person for the purpose of assessments.

Signature of the Student : Rpandey 19/12/20

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HSIR 13 – CSE – B. 106119100

19/05/21 END-SEMESTER Rajneesh Pandey

Part – A

Question:

(1)

Production function

$$Q = 5L - 0.5L^2$$

Q = No. of products produced per hour.

L = Number of workers

Labour	TP	AP (TP/Q)	MP
0	0	0	–
1	4.5	4.5	4.5
2	8	4	3.5
3	10.5	3.5	2.5
4	12	3	1.5
5	12.5	2.5	0.5
6	12	2	-0.5
7	10.5	1.5	-1.5
8	8	1	-2.5

The following 3 stages

Stage 1 : Labour $\in \{0, 1\}$

Stage 2 : Labour $\in \{2, 3, 4, 5\}$

Stage 3 : Labour $\in \{6, 7, 8\}$

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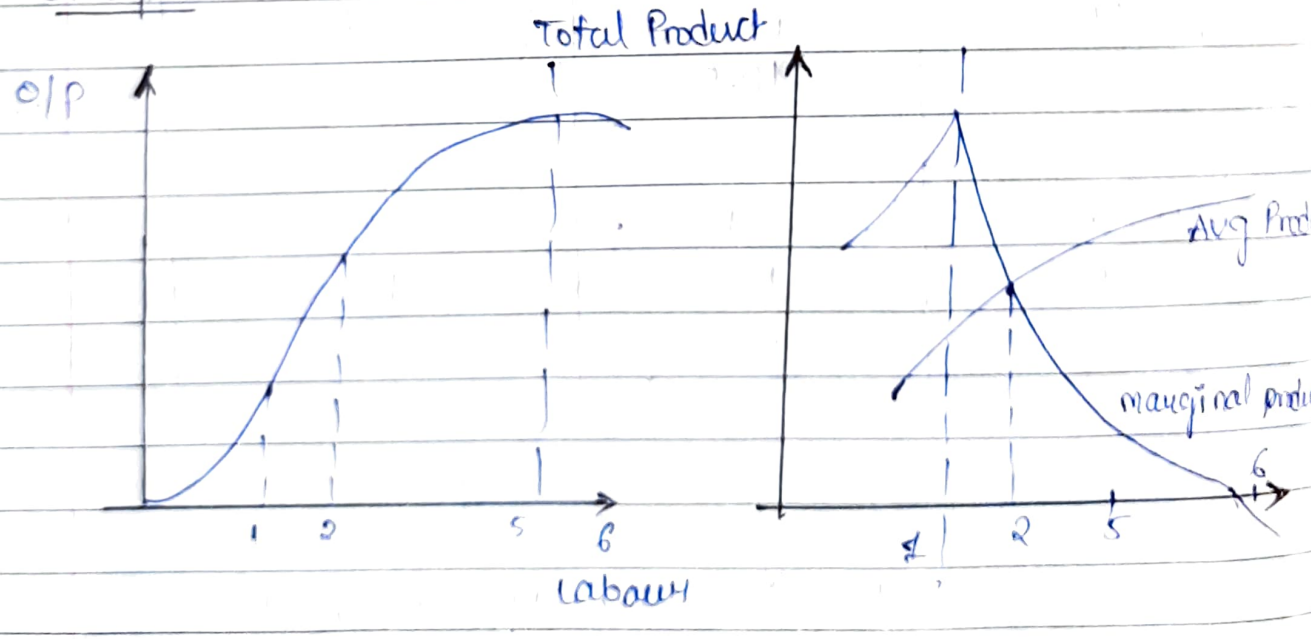
In stage 1,

The TP is in increasing stage till the end of this stage. It goes from 0-4.5 here.

Now, in stage 2, TP increases but an dimnishing rate and it reaches max value at the end of this stage. It goes from 4.5 - 12.5 here

In stage 3, TP decrease and TP slopes downword.
MP is negative here. TP decreases from 12 - 8 here.

Graphs:



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Question (2) Given

$$q = 10q_1^{1/2} + 5q_2^{1/2}$$

Substituting $q_1 = xq_1$ and $q_2 = xq_2$ in equation

$$q' = 10(xq_1)^{1/2} + 5(xq_2)^{1/2}$$

$$q' = 10x^{1/2} q_1^{1/2} + 5x^{1/2} q_2^{1/2}$$

$$= x^{1/2}(10q_1^{1/2} + 5q_2^{1/2})$$

$$\boxed{q' = x^{1/2} \cdot q}$$

As, q' is $(x^n)q$ $\Rightarrow$ Thus the function q is homogeneous.

Question (3)

(A) $U(x,y) = xy$

$$\frac{\partial U}{\partial x} = MU_x = y \quad , \quad \frac{\partial U}{\partial y} = MU_y = x$$

as, the marginal utility of x is y and the marginal utility of y is x, they both need to be keep constant when the derivation of other is calculated.

$\therefore$ this shows the constancy of marginal utilities of x & y.

$$MSR = \frac{MU_x}{MU_y} = y/x$$

$$\frac{\partial(MRS)}{\partial x} = -y/x^2$$

x, y can't be −ve ⇒ MRS decreases with increase x

(B) $U(x,y) = x^2y^2$

$$MU_x = \frac{\partial U}{\partial x} = 2xy^2 \qquad MU_y = \frac{\partial U}{\partial y} = 2x^2y$$

x, y can't be negative, marginal utilities are increasing with x and y

⇒ increasing marginal utility

$$MRS = \frac{MU_x}{MU_y} = \frac{2xy^2}{2x^2y} = \frac{y}{x}$$

$$\frac{\partial(MRS)}{\partial x} = \frac{-y}{x^2}$$

x, y can't be negative → MRS decrease with increase in x.

(C) $U(x,y) = \ln x + \ln y$

$$MU_x = \frac{\partial U}{\partial x} = \frac{1}{x} \qquad MU_y = \frac{\partial U}{\partial y} = \frac{1}{y}$$

(as x increases, MU_x decrease)

(as y increase, MU_y decrease)

Decreasing marginal utility

$MRS = \frac{MU_x}{MU_y} = y/x$

$\frac{\partial (MRS)}{\partial x} = -y/x^2$

x, y can't be -ve ⇒ MRS decreases with increase in x

All 3 utility function show decreasing MRS.

Question (4)

$C(y) = 10y^2 + 1000$

Average cost is minimized when marginal cost is equal to Average cost. because MC cuts the AC curve at minimum AC

$$\boxed{MC = \frac{\partial C}{\partial y} = 20y}$$

$AC = \frac{C}{y} = 10y + \frac{1000}{y}$

$MC = AC$

$20y = 10y + \frac{1000}{y} \Rightarrow y^2 = 100$

$\boxed{y = 10}$

At $y = 10$, average cost is minimized

∴ level of o/p ⇒ 2000

$(10 \times (10)^2 + 1000)$

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Question (5)

Budget line : A line consisting of all the possible combinations of the two goods a consumer can buy using all his income/ budget.

price of Good 1 = $8p_1$
price of Good 2 = $2p_2$

New income = $2M$

∴ Budget line := $8p_1 + 2p_2 = 2m$.

PART - B (Do any 3)

Question (7)

Ordinal Approach to the Analysis of consumer equilibrium.

The Ordinal Approach to Consumer Equilibrium asserts that the consumer is said to have attained equilibrium when he maximized his total utility for the given level of his income and the existing prices of goods and services.

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2nd condition for Consume Equilibrium according to ordinal approach

1. Necessary or First Order Condition :

This condition is empressed as

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

by implication

$$\frac{MU_x}{MU_y} = MRS_{x,y}$$

$$\boxed{MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{P_x}{P_y}}$$

supplemantary or second order codition.

2. This cond^n require that nessesory codition must be accomplished at the higuest possible indifference curve on the indifference map

Indifference curve

It shows the consumption bundles of 2 goods that give the consumer the same level of satisfaction.

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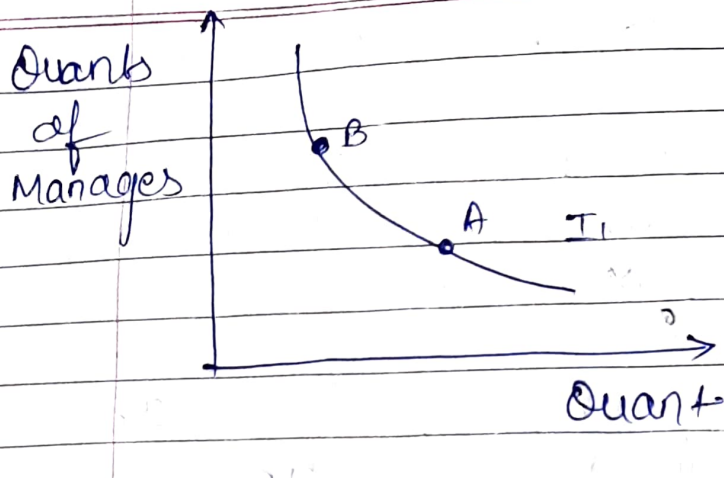

A, B and all other bundles on I_1 makes Husky equally happy.

→ four properties of indifference curve

1. Indifference curves are downward sloping
2. Indifference curves cannot cross
3. Higher indifference curves are preffered to lower ones
4. Indifference curves are bowed inward

Indifference Map :
Contains different curves showing varying levels of utility across different combination of explicts.

Budget line :
line that tells different qualities consumer can buy according to budget.

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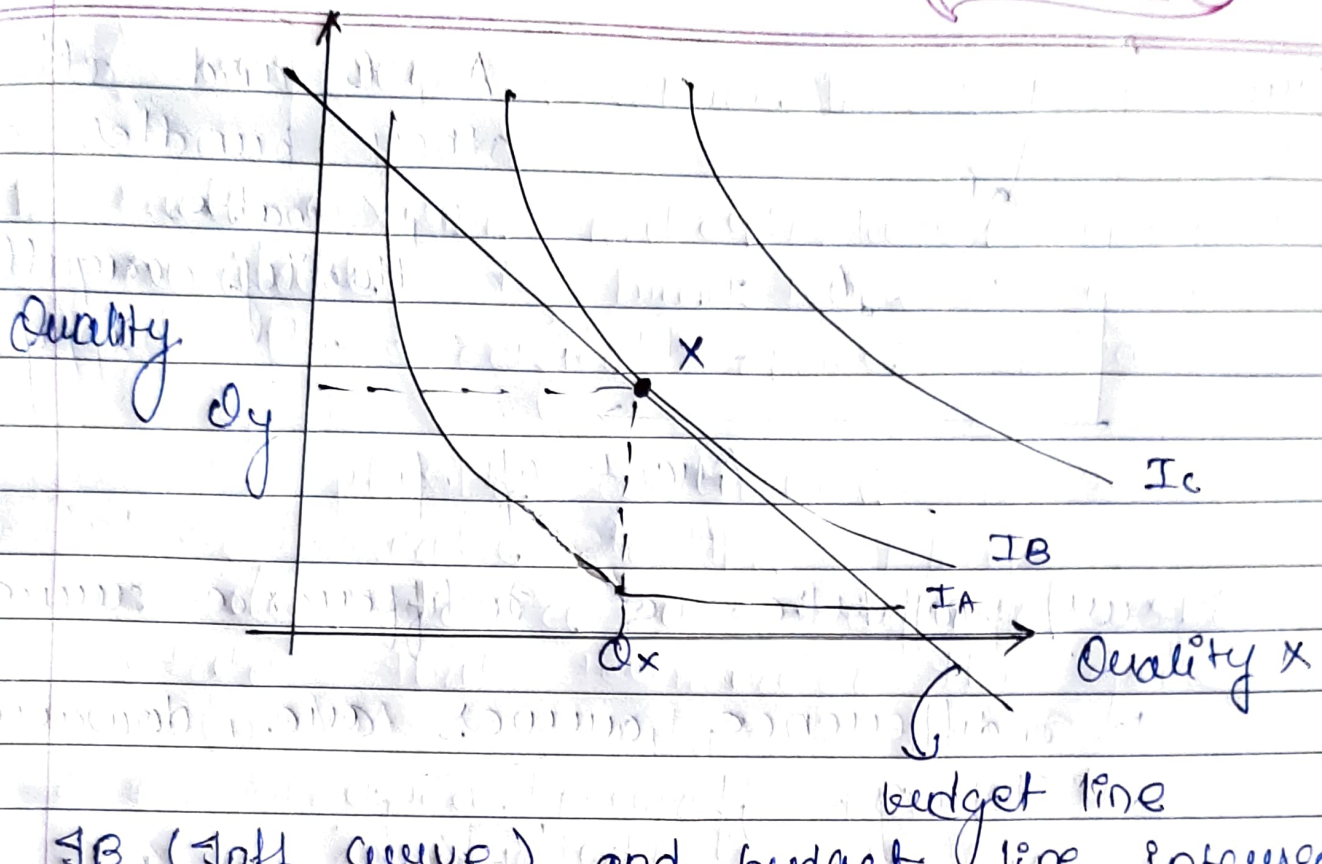

IB (Indf curve) and budget line intersects at point X.

Therefore consumer equilibrium is reached at point X (with Ox and Oy)

Intersection of budget line and indifference curve is the consumer equilibrium point

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Question (8)

Game Theory

Game Theory is a branch of mathematics analysis developed to study decision making in conflict situation. These situation include those in which players makes strategic decision that take into account each other's actions and responses

Game theory is a tool used to analyse strategic behaviour that recognition mutual interdependence and takes account of the expected behaviour of others.

All games resolves three feature/component

1) State gies:
Rules - Plan of Action for playing a game.

2) Payoff: Value associated with a possible outcome

3) optimal strategy: strategy that maximise a player's expected pay off

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Assumption in Game Theory

1. Each decision maker (player) has available to him two or more well-specified choices (called strategy)
2. Every possible combination of strategy available to the players leades to a well-defined end state that terminator the game
3. A specified payoff for each player is associated with each end state
4. Each player has perfect knowledge of the game and of hey opposition, that is she known in detail full rules of the game
5. All decision makers are rational

Question (9) -

Laws of Return to Scale:

→ Relationship between scale and efficiency
→ It is a long run concept (where all input variables are varying)

Returns to scale refers to the relationship between change in output and proportionate changes in all factors of production.

- Constant return to scales
- Decreasing return to scales
- Increasing return to scales

→ Increasing return to scales.

A production function for which any given proportionate chang in all inputs lead to an more than proportional change in output

$$Q = f(L, K)$$

$$Q^{\wedge} = f(L + L\ 10\%, K + K\ 10\%)$$

Input increases 10% → o/p increases by more that 10%

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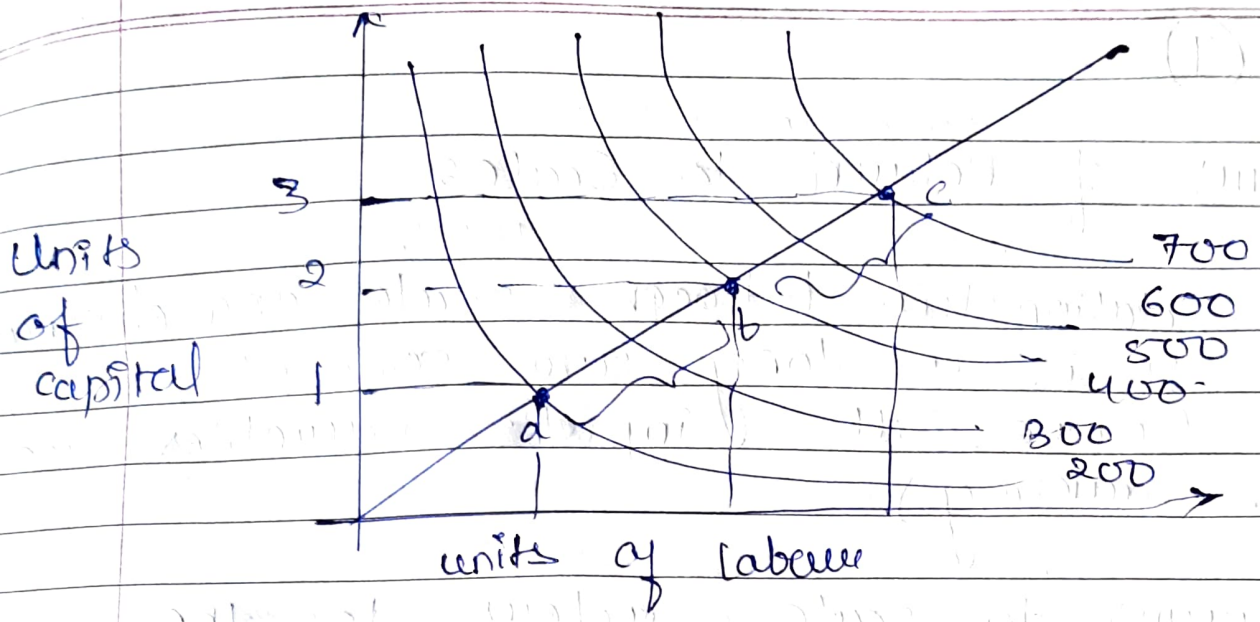
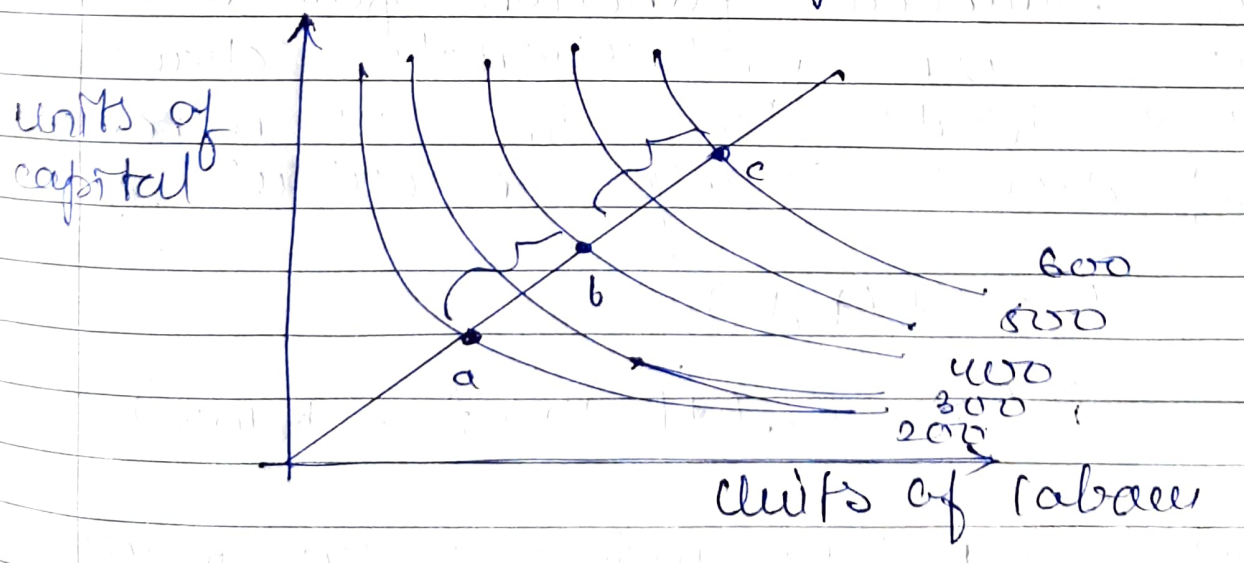


→ Constant Return to scales :

A production function for which a proportional change in all inputs causes which a output proportional change by some proportion

i/p → increase by 10% o/p. ↑ by 10%



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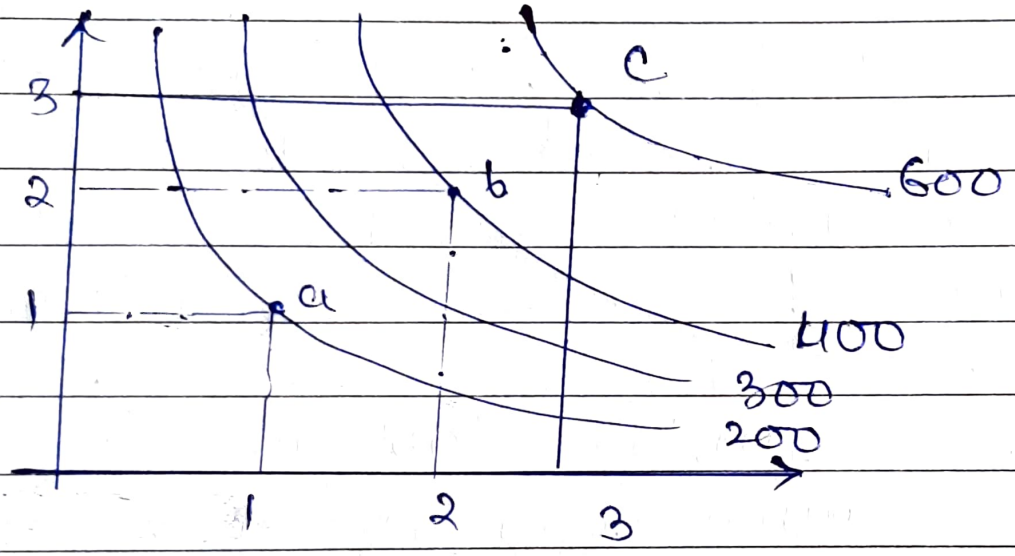
→ Decreasing return to scale

proportion change in all inputs → a less than proportional change in output.

i/p ↑ by 10% → o/p ↑ by 5%



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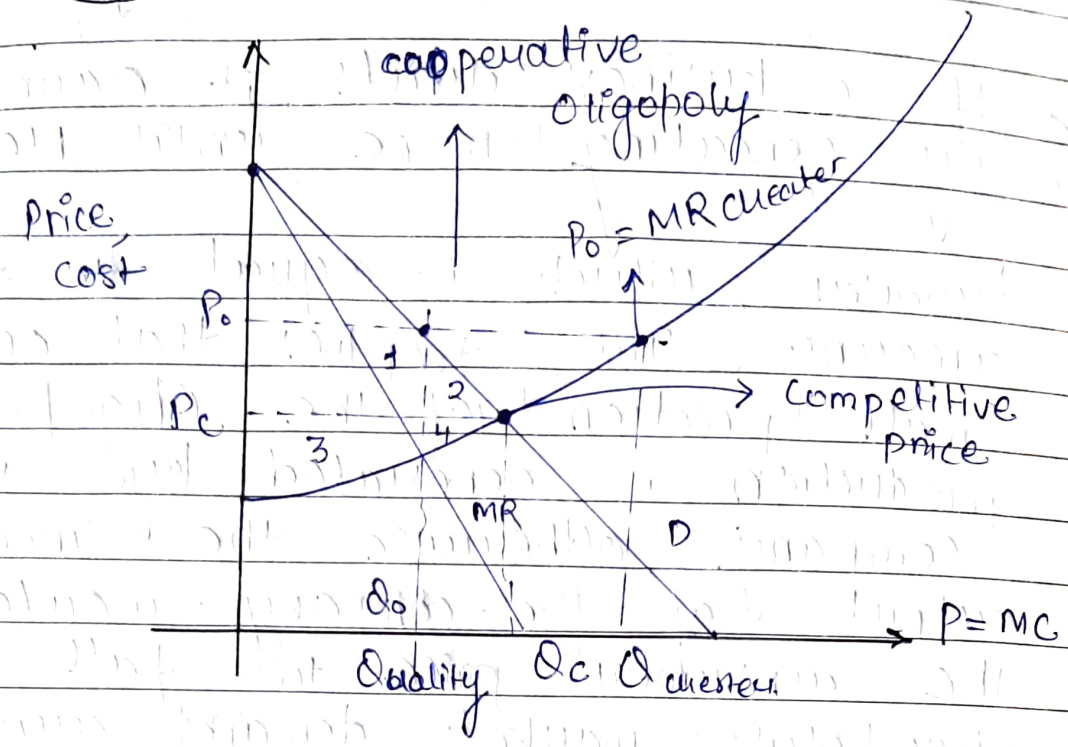
Question 10 :

(A)



If companies in a corbel collaborate by limiting quality at higher prices, then each company recives P_o for its commodely by limiting its quality to the agreed Q_o level. and each company earns revese above its maugincal cost represented in the diagram by areas 1+3.

This oligopoly thus gains, what a monopoly will earn.

→ If none of the members of the causel agree, the Quality agree to Q_c and the market price fall to the compeletion P_c price and each business in the oligopoly recieves.

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3+4 more than its marginal cost.

→ If a business cheats, it earns 1+3+2+4 by generating more until MC=P₀, greater, which is equal to the amount. This implies that only a small portion of the oligopoly production is generated by the company. otherwise the increased output of the company would cause the consumer price to fall, and oligopoly's market demand curve as a whole would move to the left.

10 (B) As, Total cost = TC(q)

$$TC(q) = 4q - q^2 + 2q^3$$

Marginal cost:

$$MC(q) = \frac{d(TC(q))}{dq} = 4 - 2q + 6q^2$$

Average cost:

$$AC(q) = \frac{TC(q)}{q} = 4 - q + 2q^2$$

For average cost AC(q) to be minimum

$$AC(q) = 4 - q + 2q^2$$

$$\frac{d(AC(q))}{dq} = -1 + 4q = 0 \quad \boxed{q = 1/4}$$

$$\frac{d^2(AC(q))}{dq^2} = 4 > 0,$$ so at relative minimum.

level of output = $AC(1/4)$

$$= 4 - 1/4 + 2(1/4)^2$$

$$= \frac{15}{4} + 2/16 = \frac{31}{8}$$

$$\boxed{\text{level of output} = \frac{31}{8}}$$

when AC is minimum i.e. at $q = 1/4$

$$AC(q) = AC(1/4) = 31/8$$

$$MC(q) = 4 - 2q + 6q^2$$

$$MC(1/4) = 4 - 2(1/4) + 6(1/10)$$

$$\boxed{MC(1/4) = 31/8}$$

$$\boxed{AC(1/4) = 31/8}$$

when AC is minimum $\boxed{AC = MC = \frac{31}{8}}$