

$$\Delta Q = Q_1 - Q_2$$

Initial - New

$$\frac{\Delta Q}{\Delta P} = \frac{\partial Q}{\partial P} \frac{dP}{dP}$$

Unit 3 Elasticity of Demand and Supply

Numerical

17. 2080 Q.No. 19 Consider the following demand schedule:

Points	A	B	C	D	E
Income (Rs)	10,000	20,000	30,000	40,000	50,000
Demand (Units)	200	400	600	800	1,000

a. Compute the income elasticity of demand at movement from B to D and D to B by proportion method. $\rightarrow \gamma_{ED} = \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q}$ [4]

b. Compute the income elasticity of demand at midway between B and D and D and B by arc method. Why is arc method considered as more appropriate method than proportion method? [4+2]

c. How do firm use price elasticity of demand in business decision making? Explain with suitable examples. [5]

Ans: (a) 1, 1 (b) 1, 1

84/2

(a) Income Elasticity of demand E_Y :

$$E_Y = \frac{\% \text{ change in Quantity of demand}}{\% \text{ change in Income}}$$

$$= \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q}$$

Movement from B to D.

$$\text{Initial income (Y)} = \text{Rs. } 20,000$$

$$\text{New income (Y}_1\text{)} = \text{Rs. } 40,000$$

$$\text{Initial quantity (Q)} = 400 \text{ unit}$$

$$\text{New quantity (Q}_1\text{)} = 800 \text{ unit}$$

Now,

$$E_Y = \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q} = \frac{400}{20,000} \times \frac{20,000}{400} = 1$$

where,

$$\Delta Q = Q_1 - Q$$

$$= 800 - 400$$

$$= 400 \text{ unit}$$

$$\Delta Y = Y_1 - Y$$

$$= 40,000 - 20,000$$

$$= \text{Rs. } 20,000$$

Movement from D to B

$$\text{Initial income (Y)} = \text{Rs. } 40,000$$

$$\text{New income (Y}_1\text{)} = \text{Rs. } 20,000$$

$$\text{Initial quantity (Q)} = 800 \text{ unit}$$

$$\text{New quantity (Q}_1\text{)} = 400 \text{ unit}$$

$$\Delta Q = Q_1 - Q$$

$$= 400 - 800$$

$$= -400 \text{ unit}$$

$$\Delta Y = Y_1 - Y$$

$$= 20,000 - 40,000$$

$$= -\text{Rs. } 20,000$$

$$\text{Now, } E_Y = \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q} = \frac{-400}{-20,000} \times \frac{40,000}{800} = 1$$

∴ Both income elasticity demand from B to D and D to B is equal. Hence, it is unitary elasticity of demand.

⑥ From Arc method B to D

Income Elasticity of demand E_Y :

$$\begin{aligned} & \frac{\Delta Q}{\Delta Y} \times \frac{Y + Y_1}{Q + Q_1} \\ &= \frac{400}{20,000} \times \frac{20,000 + 40,000}{400 + 800} \\ &= \frac{400}{20,000} \times \frac{60,000}{1200} \\ &= 1 \end{aligned}$$

From Arc method D to B

Income Elasticity of demand E_Y :

$$\begin{aligned} &= \frac{\Delta Q}{\Delta Y} \times \frac{Y + Y_1}{Q + Q_1} \\ &= \frac{400}{20,000} \times \frac{40,000 + 20,000}{800 + 400} \\ &= \frac{400}{20,000} \times \frac{60,000}{1200} \\ &= 1 \end{aligned}$$

∴ Both income elasticity of demand by using Arc method is also resulted in 1. Equally.

Reason:

Arc method considered as appropriate method than percentage method because, Arc methods add new quantity and new price, then it will be change than percentage method. So, Arc method is appropriate.

☐ Pricing Decision

- If demand is **elastic** ($PED > 1$) → firm lowers price to increase total revenue.
- If demand is **inelastic** ($PED < 1$) → firm increases price to raise revenue.

☐ Revenue Maximization

- Firms check PED to decide price where **total revenue is highest**.

☐ Price Discrimination

- Different prices in different markets based on elasticity.
- Example: student discounts, airline ticket pricing.

☐ Production Planning

- High elasticity → produce more at a lower price.
- Low elasticity → produces less but sells at a higher price.

Marketing & Advertising

- If demand is elastic $\rightarrow$ more advertising to make demand less elastic (brand loyalty).

Examples

- Petrol (Inelastic)**
Price increases $\rightarrow$ people still buy $\rightarrow$ firms earn more revenue.
- Luxury goods (Elastic)**
Price increases $\rightarrow$ demand falls $\rightarrow$ firms may reduce price.

price $\nearrow \rightarrow 0$ (circled)

autonomous price $\frac{0}{\text{price}}$ autonomous

19. 2078 Q.No. 19 Consider the following table:

Points:	A	B	C	D	E
P_x	8	6	4	2	0
Q_{sx}	50	40	30	20	10
Q_{dx}	0	15	30	45	60

- Derive linear demand and supply functions.
- Graph Q_{sx} and Q_{dx} and determine equilibrium price and quantity.
- Compute price elasticity of supply at movement from B to D and D to B by (i) percentage method and (ii) arc method. Which method is more appropriate and why? [4+2]
- How do business firms use the concept of price elasticity of demand in business decision making? Explain. [5]

Ans: (a) $Q_{dx} = 60 - 0.75P_x$; $Q_{sx} = 10 + 5P_x$ (b) Rs. 4 and 30 units (c) (i) 0.75 and 0.5 (ii) 0.666 and 0.666

$\rightarrow$ supⁿ The linear equation of demand is $Q_{dx} = a + bP_x$

$a = \text{autonomous demand} = 60$

$$b = \frac{\Delta Q}{\Delta P} = \frac{Q_1 - Q}{P_1 - P} = \frac{15 - 0}{6 - 8} = \frac{15}{-2} = -7.5$$

$\therefore$ linear equation demand function $Q_{dx} = a + bP_x$
 $= 60 + (-7.5)P_x$
 $= 60 - 7.5P_x$ — (1)

Supply function

$$Q_{sx} = a - bP_x$$

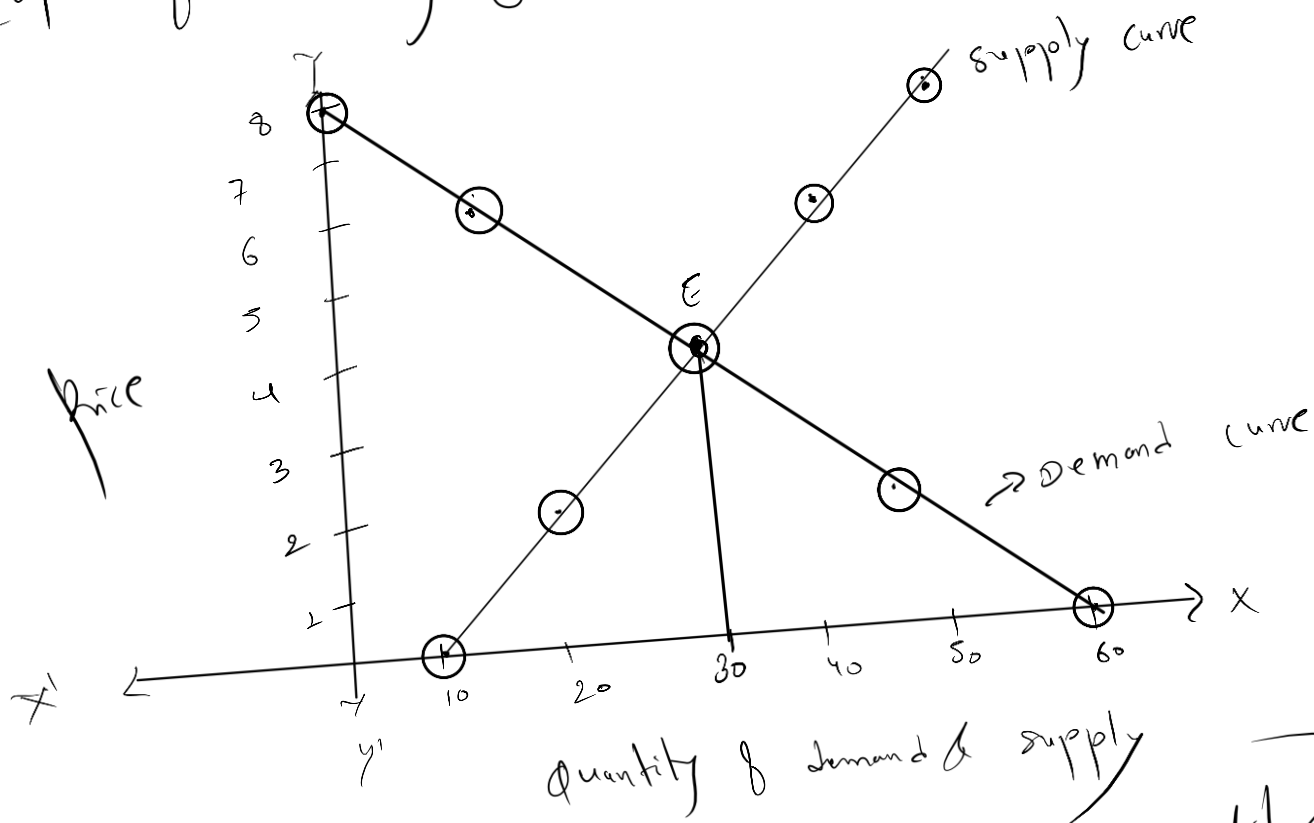
$a = \text{autonomous supply} = 10$

$$b = \frac{\Delta Q_s}{\Delta P} = \frac{Q_1 - Q}{P_1 - P} = \frac{40 - 50}{6 - 8} = \frac{-10}{-2} = 5$$

Now, linear Equation supply function $Q_{sn} = a + bP_n$

$\therefore$ linear supply function is $Q_{sn} = 10 + 5P_n$ Ans

(b) Calc of deriving graph: Q_{dn} and Q_{sn} Here we are:



$\therefore$ According to the above graph, equilibrium quantity 30 units which corresponding price Rs. 4

(c) price Elasticity of supply = $\frac{\Delta Q_s}{\Delta P_n} \times \frac{P_n}{Q_n}$

Moving from B to D

$$\Delta Q_s = Q_1 - Q_2$$

$$= 20 - 40$$

$$= -20$$

$$\Delta P = P_1 - P_2$$

$$= 2 - 6$$

$$= -4$$

$$= \frac{-20}{-4} \times \frac{6}{40}$$

$$= 0.75$$

Arc method

$$E_s = \frac{\Delta Q}{\Delta P} \times \frac{P + P_1}{Q + Q_1}$$

(d) Explain

Unit 4: Analysis of consumer behavior

1. State the condition for equilibrium under the cardinal approach.

- Consumer equilibrium occurs when the marginal utility of money is equal in all uses and:
 $MU_x/P_x = MU_y/P_y = MU_m$
- जब उपभोक्ताले आफ्नो आम्दानी यस्तो तरिकाले खर्च गर्छ कि प्रत्येक वस्तुमा प्राप्त हुने सीमांत उपयोगिता बराबर हुन्छ:
 $MU_x/P_x = MU_y/P_y = MU_m$

2. Write any four assumptions of the cardinal approach.

- Utility is measurable (cardinal measurement).
उपयोगिता मापन गर्न सकिन्छ।
- Marginal utility diminishes.
सीमांत उपयोगिता घट्दै जान्छ।
- Utility of money is constant.
पैसाको उपयोगिता स्थिर हुन्छ।
- Consumer is rational.
उपभोक्ता विवेकी हुन्छ।

3. List any four assumptions of indifference curve analysis.

- Consumer is rational.
उपभोक्ता विवेकी हुन्छ।
- Utility is ordinal (ranked, not measured).
उपयोगिता क्रमिक रूपमा तुलना गरिन्छ।
- Diminishing marginal rate of substitution.
सीमांत प्रतिस्थापन दर घट्दै जान्छ।

- Consistency in choice.
रोजाइमा स्थिरता हुन्छ।

4. Define Engel curve.

- Engel curve shows the relationship between income and quantity demanded of a good.
एङ्गेल वक्रले आम्दानी र वस्तुको मागबीचको सम्बन्ध देखाउँछ।

5. Write any four assumptions of the indifference curve.

- Two goods are considered.
दुई वस्तु मानिन्छन्।
- Consumer is rational.
उपभोक्ता विवेकी हुन्छ।
- Non-satiation (more is better).
बढी वस्तु मनपर्छ।
- Diminishing marginal rate of substitution.
सीमांत प्रतिस्थापन दर घट्छ।

6. Why does the IC slope downwards?

- To maintain the same satisfaction, an increase in one good requires a decrease in another.
एउटाको मात्रा बढ्दा समान सन्तुष्टि राख्न अर्को घटाउनुपर्छ।

7. Write any three characteristics of an indifference curve.

- Downward sloping.
तल झर्ने हुन्छ।
- Convex to origin.
उत्पत्तिबिन्दुतर्फ उभिएको हुन्छ।

- ICs never intersect.
IC हरू कहिल्यै काटिँदैनन्।
-

8. Why is the indifference curve convex to the origin?

- Due to the diminishing marginal rate of substitution.
सीमांत प्रतिस्थापन दर घट्दै जाने भएकाले।

9. Derive PCC for substitute goods.

- For substitute goods, PCC slopes downward, showing that more of one good is consumed when the price of another rises.
प्रतिस्थापन वस्तुमा PCC तलतिर ढल्किन्छ, किनकि एउटा वस्तुको मूल्य बढ्दा अर्कोको उपभोग बढ्छ।

10. What is the Income Consumption Curve (ICC)?

- ICC shows the effect of a change in income on consumption, keeping prices constant.
ICC ले मूल्य स्थिर हुँदा आम्दानी परिवर्तनले उपभोगमा पार्ने प्रभाव देखाउँछ।

11. Why does a rational consumer choose higher indifference curve?

- Because higher IC gives higher satisfaction.
माथिल्लो IC ले बढी सन्तुष्टि दिन्छ।

15. Explain the income effect for inferior and normal goods

Answer:

The **income effect** refers to the change in quantity demanded of a good due to a change in real income (purchasing power), holding prices constant. When the price of a good changes, the consumer's real income changes, which affects consumption.

Income Effect for Normal Goods

A **normal good** is one whose demand increases when income increases and decreases when income falls.

- When real income increases, the consumer purchases more of the good.
आम्दानी बढ्दा उपभोक्ताले वस्तुको माग बढाउँछ।
- When real income decreases, demand falls.
आम्दानी घट्दा माग घट्छ।
- The income effect is **positive**.
आय प्रभाव सकारात्मक हुन्छ।
- Graphically, the Income Consumption Curve (ICC) slopes upward.
ICC माथितिर उकालो हुन्छ।
- Example: rice, clothes, education.
उदाहरण: चामल, कपडा, शिक्षा।

Income Effect for Inferior Goods

An **inferior good** is one whose demand decreases when income increases.

- When real income increases, demand for inferior goods falls.
आम्दानी बढ्दा न्यूनस्तरीय वस्तुको माग घट्छ।
- When real income decreases, demand rises.
आम्दानी घट्दा यस्तो वस्तुको माग बढ्छ।

- The income effect is **negative**.
आय प्रभाव नकारात्मक हुन्छ।
- ICC may bend backward.
ICC पछाडि फर्किन सक्छ।
- Example: low-quality food, second-hand goods.
उदाहरण: सस्तो खाना, पुराना सामान।

Critical Explanation

- Income effect depends on **nature of goods**.
आय प्रभाव वस्तुको प्रकृतिमा निर्भर हुन्छ।
- It plays a key role in **consumer equilibrium**.
यसले उपभोक्ता सन्तुलनमा महत्वपूर्ण भूमिका खेल्छ।
- For **Giffen goods**, income effect is strongly negative and dominates substitution effect.
गिफेन वस्तुमा आय प्रभाव अत्यधिक नकारात्मक हुन्छ।

16. Explain the price effect for normal substitutes. How can it be decomposed into income and substitution effects?

The **price effect** shows how the quantity demanded of a good changes when its price changes, keeping other factors constant.

Price Effect for Normal Substitute Goods

Substitute goods are those that can replace each other (e.g., tea and coffee).

- When price of one good falls, demand for it increases.
एउटा वस्तुको मूल्य घट्दा यसको माग बढ्छ।
- Demand for substitute good decreases.
प्रतिस्थापन वस्तुको माग घट्छ।

- Price effect is **negative** (inverse relationship).
मूल्य प्रभाव नकारात्मक हुन्छ।

Decomposition of Price Effect

The price effect can be divided into two parts:

1. Substitution Effect

- Occurs due to a change in relative prices.
सापेक्ष मूल्य परिवर्तनका कारण हुन्छ।
- Consumer substitutes a cheaper good for an expensive one.
सस्तो वस्तु महँगोको सट्टा प्रयोग गरिन्छ।
- Always **negative**.
सधैं नकारात्मक हुन्छ।

2. Income Effect

- Occurs due to a change in real income.
वास्तविक आम्दानी परिवर्तनका कारण हुन्छ।
- For normal goods, the income effect is **positive**.
सामान्य वस्तुमा आय प्रभाव सकारात्मक हुन्छ।

Total Price Effect

Price Effect = Substitution Effect + Income Effect

- For normal goods, both effects work in same direction.
सामान्य वस्तुमा दुवै प्रभाव एउटै दिशामा काम गर्छन्।
- Hence, demand increases significantly when price falls.
त्यसैले मूल्य घट्दा माग धेरै बढ्छ।

Critical Explanation

- Substitution effect is **pure price response**.
प्रतिस्थापन प्रभाव शुद्ध मूल्य प्रतिक्रिया हो।
- Income effect reflects **purchasing power**.
आय प्रभाव क्रयशक्ति दर्शाउँछ।
- Hicks and Slutsky approaches explain decomposition differently.
Hicks र Slutsky विधिले फरक तरिकाले व्याख्या गर्छन्।

17. What is the price effect? How can it be decomposed into the income and substitution effects?

Answer:

Meaning of Price Effect

Price effect refers to the change in quantity demanded of a good due to a change in its own price, other factors remaining constant.

- When price falls → demand increases.
मूल्य घट्दा माग बढ्छ।
- When price rises → demand decreases.
मूल्य बढ्दा माग घट्छ।

Graphical Explanation

- Movement along demand curve shows price effect.
माग वक्रमा सर्ने प्रक्रिया मूल्य प्रभाव हो।
- Indifference curve analysis explains it more clearly.
उदासीन वक्र विश्लेषणले स्पष्ट देखाउँछ।

Decomposition of Price Effect

1. Substitution Effect

- Consumer replaces expensive good with cheaper one.
महँगो वस्तुको सट्टा सस्तो वस्तु प्रयोग हुन्छ।
- Always negative.
सधैं नकारात्मक हुन्छ।
- Independent of income.
आम्दानीबाट स्वतन्त्र हुन्छ।

2. Income Effect

- Change in real income due to price change.
मूल्य परिवर्तनले वास्तविक आम्दानी परिवर्तन गर्छ।
- Can be:
 - Positive (normal goods)
सकारात्मक (सामान्य वस्तु)
 - Negative (inferior goods)
नकारात्मक (न्यूनस्तरीय वस्तु)

Combined Effect

Price Effect = Substitution Effect + Income Effect

- For normal goods → both positive demand effect.
सामान्य वस्तुमा दुवै प्रभावले माग बढाउँछ।
- For inferior goods → effects opposite.
न्यूनस्तरीय वस्तुमा विपरीत दिशा हुन्छ।

- For Giffen goods $\rightarrow$ income effect dominates.

गिफेन वस्तुमा आय प्रभाव बढी हुन्छ।

Critical Analysis

- Price effect explains **law of demand**.
मूल्य प्रभावले मागको नियम व्याख्या गर्छ।
- Helps in understanding **consumer behavior deeply**.
उपभोक्ता व्यवहार बुझ्न मद्दत गर्छ।
- Important for **policy making and pricing decisions**.
मूल्य निर्धारण र नीतिमा उपयोगी हुन्छ।

Brief Answer Questions		[2 marks]
1.	2077 Q.No. 4 Derive budget line if budget of the consumer is Rs. 10,000, price of good X is Rs. 100 and price of good Y is Rs. 200.	
2.	2073 Q.No. 5 Let a consumer selects two goods i.e. x & y for consumption having prices with Rs. 200 and Rs. 100 respectively and fixed income with Rs. 1,000. Draw Budget line.	
3.	2072 (II) Q.No. 9 Derive budget equation if a consumer has total income of Rs. 3,000 and price of X and Y goods are Rs. 50 and Rs. 70 respectively.	

Ans: $50Q_x + 70Q_y = 3,000$

Solⁿ Budget equation = $P_x Q_x + P_y Q_y$

Given,
 Budget of consumer = Rs. 10,000
 Price of good x (P_x) = Rs. 100
 Price of good y (P_y) = Rs. 200

Now,
 Budget of consumer = $P_x Q_x + P_y Q_y$
 Rs. 10,000 = $100 Q_x + 200 Q_y$
 $10,000 = 100 (Q_x + 2Q_y)$
 $100 = Q_x + 2Q_y$ ————— Q_y^2

Budget constraint

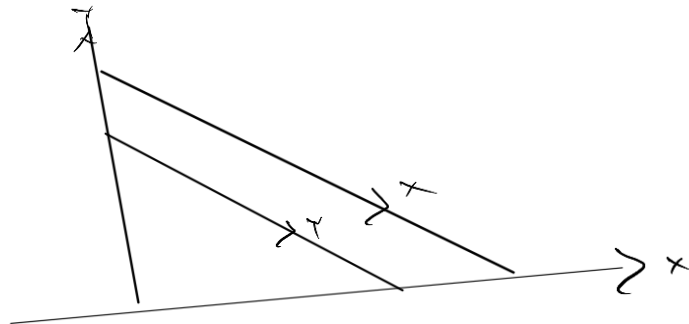
Q 14.2

Given,

price of goods X (P_x) = Rs. 200

price of goods Y (P_y) = Rs. 100

fixed income (Y) = Rs. 1000



Budget equation: $P_x Q_x + P_y Q_y$
 $1000 = 200 Q_x + 100 Q_y$ — (1)

Q 14.3

Given,

price of X goods (P_x) = Rs. 50

price of Y goods (P_y) = Rs. 70

Total income = Rs. 3000

Now,

Budget equation = $P_x Q_x + P_y Q_y$
 $3000 = 50 Q_x + 70 Q_y$ — (2)

or,

5. Fill up or complete the following table:

Combinations	Good-X	Good-Y	MRS _{XY}
A	1	15	-X
B	2	10	-5
C	3	6	-4
D	4	3	-3
E	5	1	-2

Ans: MRS_{XY} = -5, -4, -3, -2

6. Suppose, price of good-x and good-y are respectively Rs.20 and Rs.10 respectively. The consumer spends all of his money income Rs.2,000 on good-x and y. Derive the budget constraints.

Ans: $2,000 = 20.Q_x + 10.Q_y$

Solⁿ Budget = $P_x Q_x + P_y Q_y$

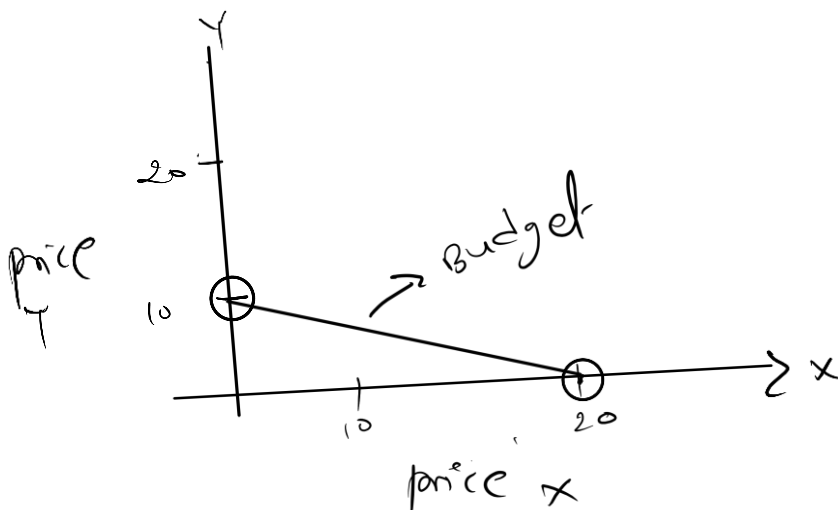
price of good x (P_x) = Rs. 20

price of good y (P_y) = Rs. 10

Consumer spends all of his income (Budget) = Rs. 2000

Budget constraint (B) = $P_x Q_x + P_y Q_y$

2000 = $20 Q_x + 10 Q_y$ — Q ✓



2082 Q.No. 14 Explain the consumer's equilibrium in cardinal approach. Price of apple is Rs. 20, price of banana is Rs. 10 and the consumer spends whole income Rs. 110 on apple and banana. Find the consumer's equilibrium when the marginal utilities (MU) of apple and banana are as follows:

सङ्ख्यात्मक उपयोगिता विश्लेषण विधिमा उपभोक्ता सन्तुलनको व्याख्या गर्नुहोस्। स्याउको मूल्य रु. २० छ, केराको मूल्य रु. १० छ र उपभोक्ताले आफ्नो सबै अम्दानी रु. ११० स्याउ र केरामा खर्च गर्दछ। स्याउ र केराको सिमान्त उपयोगिताहरू निम्नानुसार भएको अवस्थामा उपभोक्ताको सन्तुलन पत्ता लगाउनुहोस्।

Units of consumption	1	2	3	4	5	6	7
MU of apple	800	700	600	500	400	300	200
MU of banana	500	450	400	350	300	250	200

Ans: 3 and 5 units

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_m}{110}$$

→ ८४?

Cardinal utility Approach

→ There are two commodity i.e. goods X and goods Y, consumer get equilibrium when ratio of marginal utility and price of X goods ($\frac{MU_x}{P_x}$) is equal to ratio of marginal utility of price of Y goods ($\frac{MU_y}{P_y}$) and also equal to marginal utility of money (MU_m)

Price of Apple = Rs. 20 (P_x)

Price of Banana = Rs. 10 (P_y)

Whole income = Rs. 110 - Budget

$$B = P_x Q_x + P_y Q_y$$

$$110 = 20Q_x + 10Q_y$$

Explanation by Table:

let MU of apple be X ✓
MU of banana be Y ✓

$P_x = \text{Rs. } 20$

$P_y = \text{Rs. } 10$

units of Consumption	MU_x	MU_y	$\frac{MU_x}{P_x \text{ Rs. } 20}$	$\frac{MU_y}{P_y \text{ Rs. } 10}$	check
1	800	500	40	50	$1 \times 20 + 3 \times 10 = 50$
2	700	450	35	45	$2 \times 20 + 4 \times 10 = 80$
3	600	400	30	40	$3 \times 20 + 5 \times 10 = 110$
4	500	350	25	35	$4 \times 20 + 6 \times 10 = 116$
5	400	300	20	30	
6	300	250	15	25	
7	200	200	10	20	

Consumer income = **Rs. 110**

Hence, Consumer Equilibrium 3 unit and 5 unit for marginal utility of Apple and Banana.

Then,

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

$$30 = 30$$

Ans

$$\text{Budget} = P_x Q_x + P_y Q_y$$

10. 2081 Q.No. 16 Let a consumer selects two goods, i.e. x and y for consumption having prices of Rs. 1,600 and Rs. 800 respectively and fixed income with Rs. 16,000.

a. Derive budget line and determine equilibrium point when he allocates entire budget equally on two goods.

b. Let, price of x good falls to Rs. 800. Derive the new budget line and determine new equilibrium point when he spends Rs. 6,400 on x good and Rs. 9,600 on y good.

c. Derive price demand curve for x good. [4+4+2]

Ans: 3 and 5 units

a

→ solⁿ Given,

price of goods x (P_x) = Rs. 1600

Price of goods y (P_y) = Rs. 800

Fixed income Budget = Rs. 16,000

Now,

Budget equation = $P_x Q_x + P_y Q_y$

$$16,000 = 1600 Q_x + 800 Q_y$$

⇒ when $Q_y = 0$

$$16,000 = 1600 Q_x + 0$$

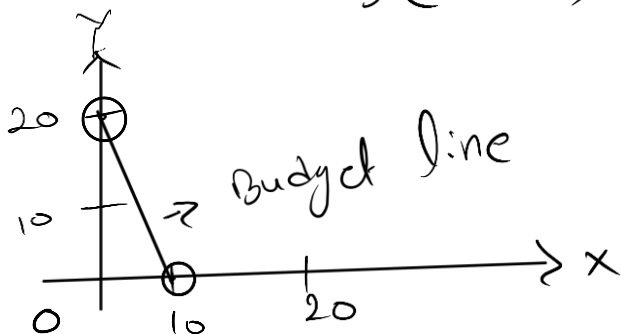
$$\therefore Q_x = 10 \text{ unit}$$

⇒ when $Q_x = 0$

$$16,000 = 0 + 800 Q_y$$

$$\therefore Q_y = 20 \text{ unit}$$

Budget line A (10, 0)
B (0, 20)



Then,

When consumer allocated entire budget equally on goods x and goods y.

goods x → 16,000 Half → Rs. 8000

goods y → 16,000 Half → Rs. 8000

And,

goods x budget = Rs. 8000

goods y budget = Rs. 8000

For equilibrium points:

$$Q_x = \frac{\text{Budget}}{P_x} = \frac{8000}{1600} = 5$$

$$Q_y = \frac{\text{Budget}}{P_y} = \frac{8000}{800} = 10$$

∴ Hence,

The equilibrium point is (5, 10) when budget equally distribution to each share.

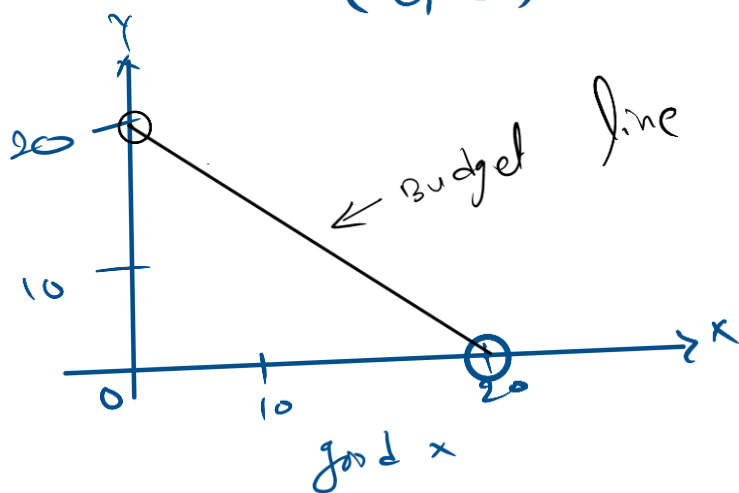
b) $P_n = \text{Rs. } 800$
 $P_y = \text{Rs. } 800$
 So, Budget = Rs. 16,000.

Budget equation = $P_n Q_n + P_y Q_y$

when $Q_n = 0$
 $Q_y = \frac{16,000}{800} = 20 \text{ unit}$

when $Q_y = 0$
 $Q_n = \frac{16,000}{800} = 20 \text{ unit}$

Budget line (20, 0) A
 (0, 20) B



Then,

For equilibrium points:

Budget of X = Rs. 6400

Budget of Y = Rs. 9600

Then,

$$Q_n = \frac{\text{Budget}}{P_n}$$

$$= \frac{6400}{800}$$

$$= 8 \text{ unit}$$

$$Q_y = \frac{\text{Budget}}{P_y}$$

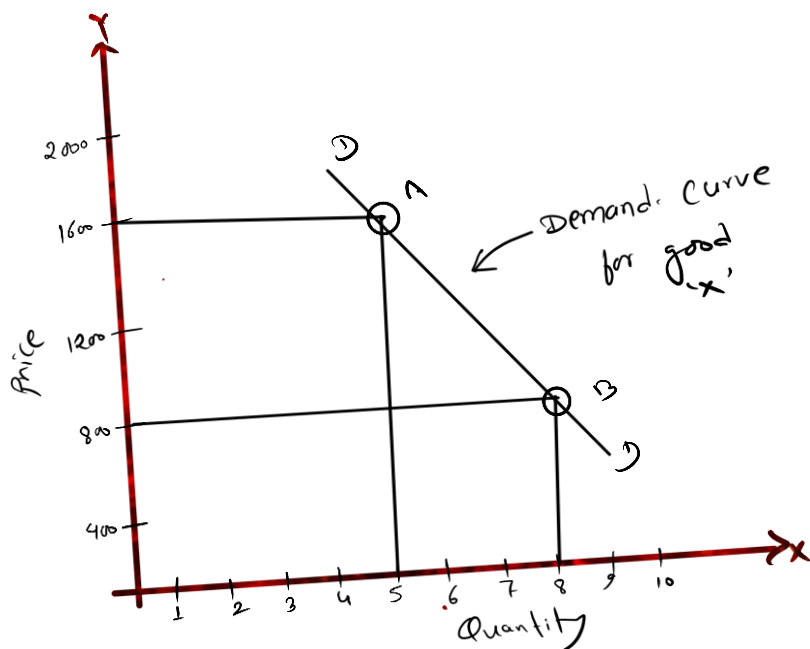
$$= \frac{9600}{800}$$

$$= 12 \text{ unit}$$

Hence, New equilibrium point at E (6, 12).

© derive price Demand for Good X.

Price of good X (P_n)	Quantity of good X (Q_n)
1600	5
800	8



6. 2074 Q.No. 16 Suppose price of commodity 'X' is Rs 100 and price of commodity 'Y' is Rs 50 and a consumer has Rs. 2,000 to spend per month on goods x and y. [10]

- Sketch the consumer's budget constraint.
- Assume that he splits his income equally between X and Y. Show where the consumer ends up on the budget constraints.
- Suppose that income rises from Rs. 2,000 to Rs. 4,000. Sketch the new budget constraint.
- Assume that he again splits total budget equally on two goods. Show where the consumer ends up on the new budget constraint.

Given,

→ Price of x goods (P_x) = Rs. 100

Price of Y goods (P_y) = Rs. 50

monthly income Budget (B) = Rs. 2000

(a) We know that,

$$\text{Budget (B)} = P_x Q_x + P_y Q_y$$

$$\text{or, } 2000 = 100 Q_x + 50 Q_y$$

$$\text{When, } Q_y = 0$$

$$\text{or, } \frac{2000}{100} = Q_x$$

$$\text{quantity of x goods } (Q_x) = 20 \text{ unit}$$

$$\text{When, } Q_x = 0$$

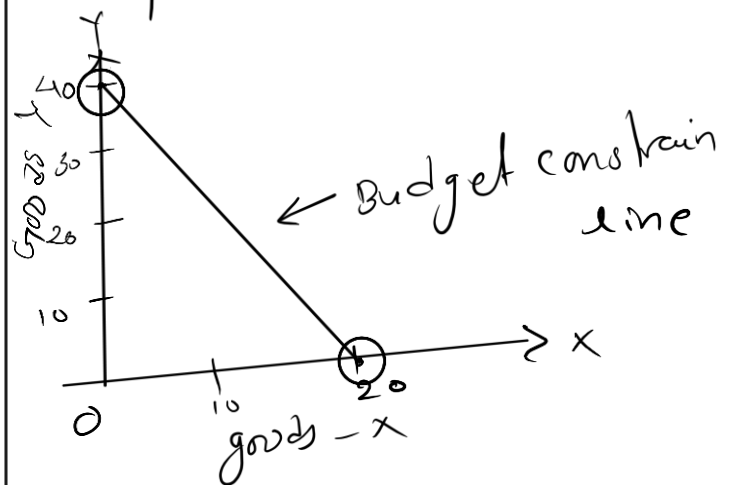
$$\text{or, } \frac{2000}{50} = Q_y$$

$$\therefore \text{quantity of goods Y } (Q_y) = 40 \text{ unit}$$

$$\text{x-goods } (20, 0) \text{ A}$$

$$\text{Y-goods } (0, 40) \text{ B}$$

Hence,
we will get budget line
A(20, 0) and B(0, 40)
respectively.



(b) According to the question,
income of the consumer
splits his income equally on
goods x and goods Y.
we will get;

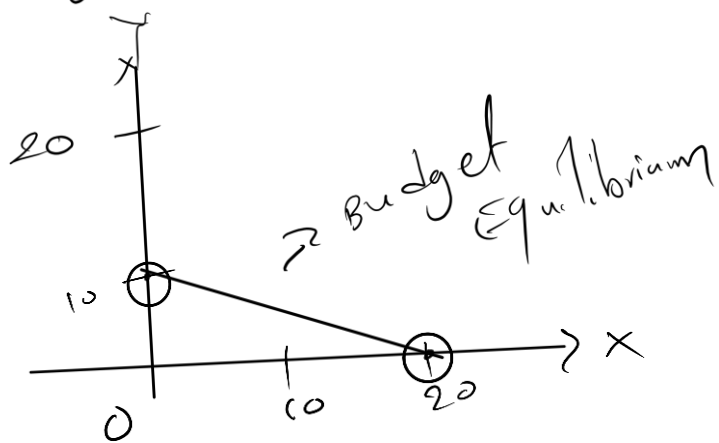
New budget
constraint →

$$Q_x = \frac{\text{Budget}}{P_x} = \frac{1000}{100} = 10 \text{ unit}$$

$$Q_y = \frac{\text{Budget}}{P_y} = \frac{1000}{50} = 20 \text{ unit}$$

∴ The consumer ends up at point at Equilibrium (10, 20).

Figure 1 A(0, 10)
B(20, 0)



© New budget, when
Income rise from 2000 to 4000
New, Budget (B) = Rs. 4000
New equation.

$$B = P_x Q_x + P_y Q_y$$

Same as (a) number

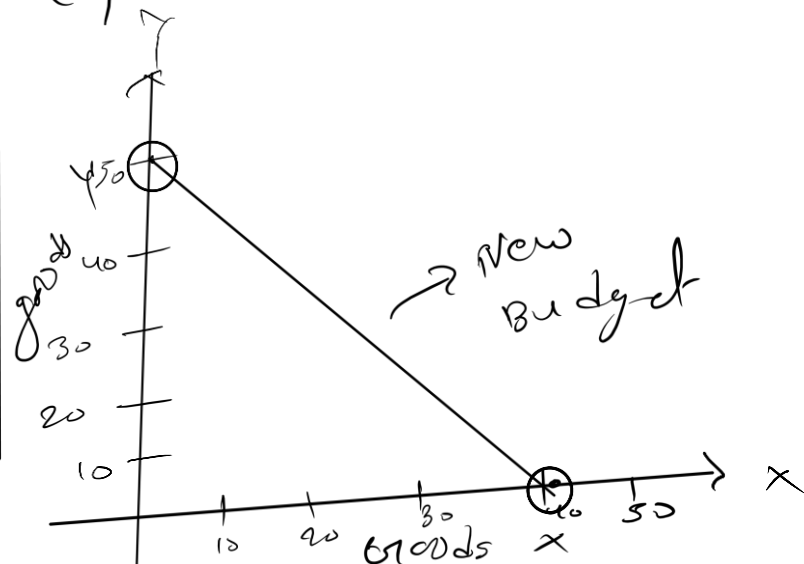
① Same as B.

Budget = 2000 for
good X, 2000 for
good Y.

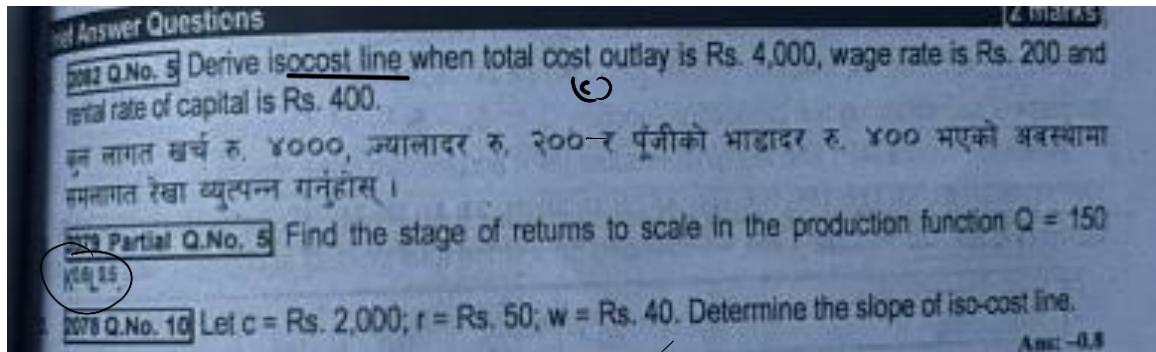
$$Q_x = \frac{\text{Budget}}{P_x} = \frac{2000}{100} = 20 \text{ unit}$$

$$Q_y = \frac{\text{Budget}}{P_y} = \frac{2000}{50} = 40 \text{ unit}$$

Equilibrium (E₂) (40, 50)



Unit 5 – Theory of Production Numerical



sqⁿ Given,

Total cost outlay = Rs. 4000

Wage rate (w) = Rs. 200

Rate of capital (k) = Rs. 400

Deriving Isoquant line - ?

Now,

Slope of Isoquant line = $-\frac{\text{Price of Labour } w}{\text{Price of Capital } k}$

$$= -\frac{200}{400}$$
$$= -\frac{1}{2}$$

We know that

total cost

$$\text{outlay} = wL + rK$$

Schedule

Combination

A

B

C

D

L

5

6

7

8

K

15

11

8

6

$$C = wL + rK$$

$$= 200 \times 5 + 400 \times 15$$

$$= 200 \times 6 + 400 \times 11$$

$$= 200 \times 7 + 400 \times 8$$

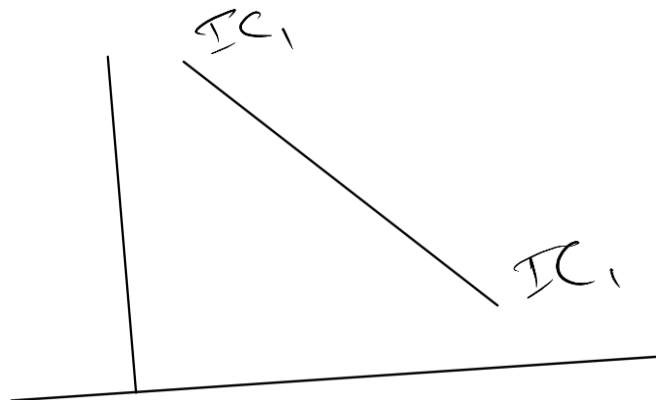
$$= 200 \times 8 + 400 \times 6$$

output
7000

5600

4600

4000



Partial Q.No. 5 Find the stage of returns to scale in the production function $Q = 150 K^{0.6} L^{0.5}$ inc, dec, constant.
 2078 Q.No. 10 Let $c = \text{Rs. } 2,000$; $r = \text{Rs. } 50$; $w = \text{Rs. } 40$. Determine the slope of iso-cost line.

→ production function $Q = 150$

$$K^{0.6} L^{0.5}$$

Now,

$$Q = A \cdot K^\alpha \cdot L^\beta$$

$$Q = A K^\alpha \cdot L^\beta$$

For return to scale

- a) $\alpha + \beta = 1$ constant $\alpha + \beta = 1$ c
- b) $\alpha + \beta > 1$ inc. $\alpha + \beta > 1$ inc ✓
- c) $\alpha + \beta < 1$ dec. $\alpha + \beta < 1$ dec.

Then,

$$\alpha + \beta$$

$$0.6 + 0.5 = 1.1$$

$$\alpha + \beta > 1 \text{ [inc]}$$

0.6 + 0.5
 1.1 > 1 which is greater than 1. So,
 It is increasing return to scale.

③ slope of Isoquant = $-\frac{\text{Price of wages}}{\text{price of capital}} = -\frac{40}{50}$

$$= -0.8$$

Ans

2071 Q.No. 7 Fill up the following isoquant schedule. [2]

Combination	Labour	Capital	MRTS _{L,R}
A	1	14	-
B	2	10	-4
C	3	7	-3
D	4	5	-2
E	5	4	-1

Solution

Combination	Labour	Capital	MRTS _{L,R}
A	1	14	-
B	2	10	4
C	3	7	3
D	4	5	2
E	5	4	1

3. On the basis of following production function, find out which one represents constant returns to scale, increasing returns to scale and decreasing returns to scale. [2]

$$Q = A K^{0.6} L^{0.4}$$

Solution

Given

$$\alpha = 0.6$$

$$\beta = 0.4$$

$$\alpha + \beta = 0.6 + 0.4 = 1$$

Since, $\alpha + \beta = 1$, it represents constant returns to scale.

$$Q = A K^{0.6} L^{0.4}$$

$$c \quad \alpha + \beta = 1$$

$$b \quad \alpha + \beta > 1$$

$$a. \quad \alpha + \beta < 1$$

$$\alpha = 0.6$$

$$\beta = 0.4$$

$$\alpha + \beta = 0.6 + 0.4 = 1$$

Since, $\alpha + \beta = 1$, it represent Constant Return to scale

$$\alpha + \beta = 1$$

MP मूल्य TR को घटती देखी जादि घटाती है।

above figure, MP is negative at 7th unit of labour.

10. 2078 Q.No. 13 Let, production function, $Q = 14L + 7L^2 - L^3$. Compute TP, AP and MP, graph them and explain three stages of production with proper reasons.

Solution

Given

Production function, $Q = 14L + 7L^2 - L^3$

$$Q = 14L + 7L^2 - L^3$$

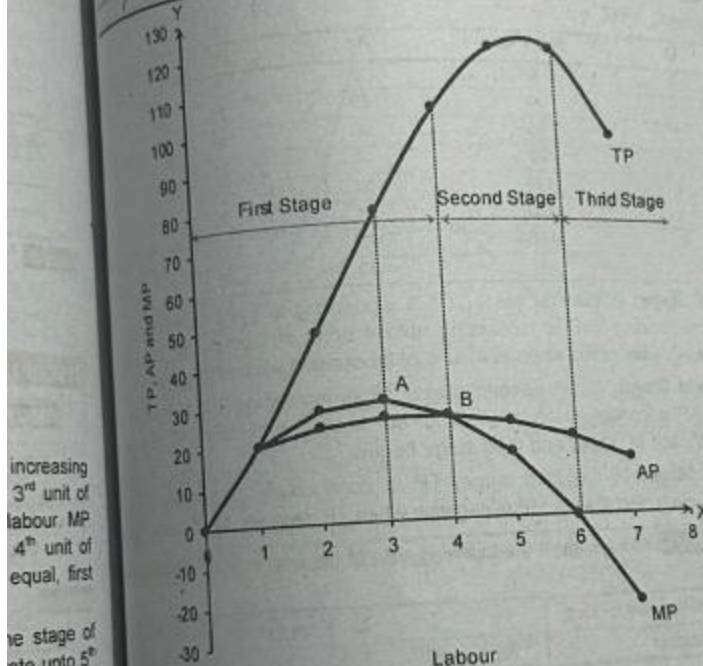
TP

$$AP = \frac{TP}{Q}$$

$$MP = \frac{\Delta TP}{\Delta Q}$$

$$AP = \frac{TP}{Q}$$

L	TP = $14L + 7L^2 - L^3$	AP = $\frac{TP}{L}$	MP = $\frac{\Delta TP}{\Delta L}$
0	0	-	-
1	20	20	20
2	48	24	28
3	78	26	30
4	104	26	26
5	120	24	16
6	120	20	0
7	98	14	-22



increasing
3rd unit of
labour. MP
4th unit of
equal, first

the stage of
rate upto 5th
continuously
ro when TP
comes zero.

The three stages of production are as follows:

First stage: First stage of production is also known as the stage of increasing returns. In this stage, TP is increasing at the increasing rate upto 3rd unit of labour. MP is increasing upto 4th unit of labour.

L	TP = $14L + 7L^2 - L^3$	AP	MP
0	$TP = 14 \times 0 + 7 \times 0^2 - 0^3 = 0$	-	-
1	20	20	20
2	48	24	28
3	78	26	30
4	104	26	26
5	120	24	16
6	120	20	0
7	98	14	-22

$$AP = \frac{TP}{Q}$$

$$MP = TP \text{ का } \frac{1}{n} \text{ अवतार}$$

$$\frac{TP}{Q}$$

$$MP = TP \frac{I}{\overline{PLGAV}} \frac{1}{\overline{PLGAV}}$$

$$Q = 16L + 8L^2 - L^3$$

Please refer to 2078 Q.No. 13

12. 2074 Q.No. 15 Using the production function $Q = 16L + 8L^2 - L^3$, Compute Total Product (TP), Average Product (AP) and Marginal Product (MP) and explain three stages of production.

Solution

Given $Q = 16L + 8L^2 - L^3$

Q	TP = $16L + 8L^2 - L^3$	AP	MP	Stages
0	0	0	0	
1	23	23	23	
2	56	28	33	First Stage
3	93	31	37	
4	128	32	35	
5	155	31	27	
6	168	28	13	Second Stage
7	161	23	-7	Third Stage

First Stage: In the first stage, TP is increasing at the increasing rate. AP is also increasing. MP is increasing upto 4 units of labour and thereafter, it is declining. First stage ends at 4th unit of labour and second stage begins.

Second Stage: In the second stage, TP is increasing but at the diminishing rate. AP is continuously diminishing. MP is also diminishing. This stage ends after 6th unit of labour and third stage begins.

Third Stage: In the third stage, TP is continuously decreasing. AP is continuously decreasing. MP is negative when TP declines, MP become negative.

13. **2073 Q.No. 14** You are given the following data of the total product at different variable factors:

Units of Variable factors	1	2	3	4	5	6	7
Total product	20	60	120	160	180	180	160

Calculate the AP and MP from the above schedule and draw a diagram representing AP and MP.

Solution

Calculation of Marginal Product and Average Product

Units of Variable factors	Total Product (TP)	Average Product (AP)	Marginal Product (MP)
0 ✓	0	-	-
1 ✓	20	20	20
2 ✓	60	30	40
3 ✓	120	40	60
4 ✓	160	40	40
5 ✓	180	36	20
6 ✓	180	30	0
7 ✓	160	22.8	-20

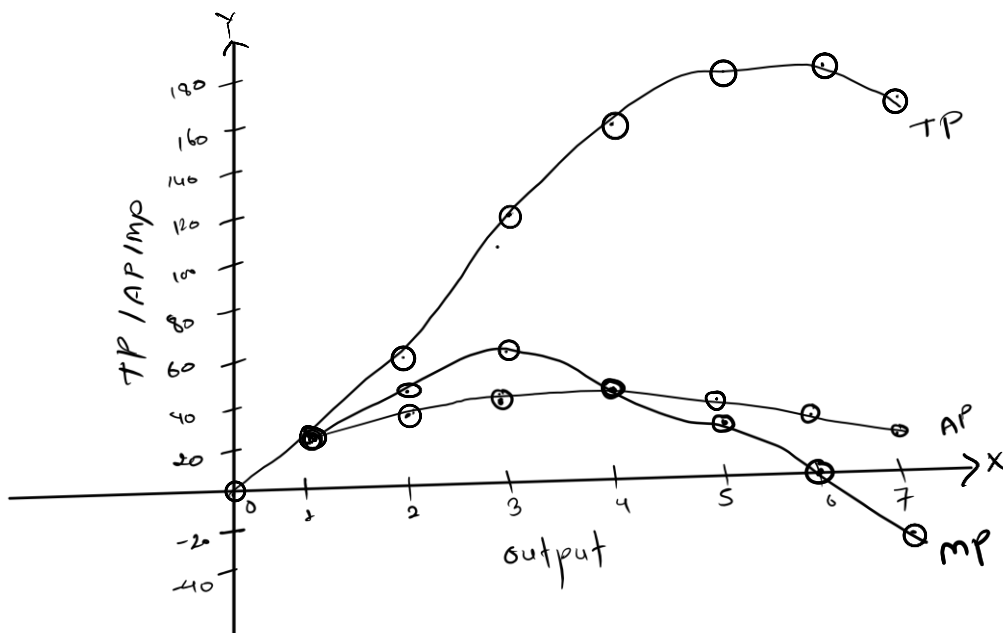


Figure--.

Q.16 Consider the following production schedule:

Schedule I				Schedule II				Schedule III			
Combination	L	K	Output	Combination	L	K	Output	Combination	L	K	Output
A	5	15	1,500	E	5	20	2,000	I	5	25	2,500
B	6	11	1,500	F	6	16	2,000	J	6	21	2,500
C	7	8	1,500	G	7	13	2,000	K	7	18	2,500
D	8	6	1,500	H	8	11	2,000	L	8	16	2,500

If a producer has total outlay of Rs.2,400, which he has to spend on two factors of production: Labour and Capital. The price of labour and capital are Rs.50 and Rs.100 respectively.

- Compute the total cost for each combination containing in each production preference schedule and identify least cost combination which maximizes output at a given total cost outlay.
- Sketch the iso-quant map from the above information.

[10]

Solution

Given

Total cost outlay (C) = Rs. 2,400

Price of labour (w) = Rs. 50

Price of capital (r) = Rs. 100

We know that,

$$C = wL + rK$$

Schedule I

Combinations	L	K	Total cost (C = wL + rK)	Output
A	5	15	$50 \times 5 + 100 \times 15 = 1,750$	1,500
B	6	11	$50 \times 6 + 100 \times 11 = 1,400$	1,500
C	7	8	$50 \times 7 + 100 \times 8 = 1,150$	1,500
D	8	6	$50 \times 8 + 100 \times 6 = 1,000$	1,500

Schedule II

Combinations	L	K	Total cost (C = wL + rK)	Output
E	5	20	$50 \times 5 + 100 \times 20 = 2,250$	2,000
F	6	16	$50 \times 6 + 100 \times 16 = 1,900$	2,000
G	7	13	$50 \times 7 + 100 \times 13 = 1,650$	2,000
H	8	11	$50 \times 8 + 100 \times 11 = 1,500$	2,000

Schedule III

Combinations	L	K	Total cost (C = wL + rK)	Output
I	5	25	$50 \times 5 + 100 \times 25 = 2,750$	2,500
J	6	21	$50 \times 6 + 100 \times 21 = 2,400$	2,500
K	7	18	$50 \times 7 + 100 \times 18 = 2,150$	2,500
L	8	16	$50 \times 8 + 100 \times 16 = 2,000$	2,500

From the above table, it is clear that combination J from schedule III is least cost combination of inputs which maximizes output at a given total cost outlay. In other words, least cost combination of inputs is 6 units of labour and 21 units of capital which maximizes output at a given total cost outlay.

$$C = 2400$$

$$w = 50$$

$$r = 100$$

$$C = wL + rK$$

DISCRIPTIVE NUMERICAL ANSWER QUESTIONS

[10 MARKS]

Q.No. 15 Consider the following production schedule:

Labour (L)	0	1	2	3	4	5	6	7
TP _L	0	20	48	78	104	120	120	98

a. Compute AP_L and MP_L.

b. Graph TP_L, AP_L and MP_L and explain three stages of production with proper reasons.

[2]

[8]

Solution

a. Here,

L	TP _L	AP _L = $\frac{TP}{L}$	MP _L = $\frac{\Delta TP}{\Delta L}$	Stages of Production
0	0	-	-	
1	20	20	20	First Stage
2	48	24	28	
3	78	26	30	
4	104	26	26	
5	120	24	16	Second Stage
6	120	20	0	
7	98	14	-22	Third Stage

H.W
~~2082 / 2081 / 2080~~
 unit - 5

H.W

Unit 2: Market Equilibrium and Efficiency

1. **2075 Q.No. 2** Let, demand function $Q_{dx} = 100 - 5P_x$, supply function = $20 + 5P$. Determine equilibrium price and quantity. Ans: Rs. 8 & 60 units

2. **2074 Q.No. 9** Suppose demand function (Q_d) = $500 - 10P$ and supply function (Q_s) = $50 + 20P$. Find the equilibrium price and quantity. Ans: Rs. 15 and 350 units

3. **2072 (II) Q.No. 2** Let, autonomous demand = 200, the slope of the demand curve = -5. Derive linear demand function. Ans: $D_x = 200 + 5P_x$

4. **2071 Q.No. 3** The following schedule shows the amount of sandwich bought by a household of Nepal at different prices.

Period	Price of Sandwich (Rs.)	Demand of Sandwich
2069	50	80
2070	75	100

Does the behaviour of the household contradict the law of demand? Give reason for your answer.

5. Derive the linear demand function when $a = 10$ and $b = 2$, where 'a' is the autonomous demand and b is the slope of the demand curve. Ans: $D_x = 10 - 2P_x$

Q.N. 1 Given,

Demand function $Q_{dx} = 100 - 5P_x$

Supply function $Q_s = 20 + 5P$

Determine Equilibrium price & Quantity = ?

Now,
For Equilibrium level

$$Q_{dx} = Q_{sx}$$

$$\text{or } 100 - 5P_x = 20 + 5P_x$$

$$\text{or } 100 - 20 = 5P_x + 5P_x$$

$$\text{or } 80 = 10P_x$$

$$\text{or } \frac{80}{10} = P_x$$

Equilibrium price is Rs. 8

And, Equilibrium Quantity,

Putting the value of P in Supply function.

$$\begin{aligned} Q_s &= 20 + 5P \\ &= 20 + 5 \times 8 \\ &= 20 + 40 \\ &= 60 \text{ unit} \end{aligned}$$

3. 2072 (II) Q.No. 2 Let, autonomous demand = 200, the slope of the demand curve = -5. Derive linear demand function.

Ans: $D_x = 200 + 5P_x$

Sol: Autonomous Demand (a) = 200
Slope of Demand Curve (b) = -5
Derive linear Demand function = ?
Now,

We know that, linear Demand function $D_x = a - bP_x$
 $= 200 - (-5P_x)$
 $= 200 + 5P_x$ is
required linear Demand function.

5. Derive the linear demand function when $a = 10$ and $b = 2$, where 'a' is the autonomous demand and b is the slope of the demand curve.

Ans: $D_x = 10 - 2P_x$

Sol: linear Demand function = ?

$$a = 10$$
$$b = 2$$

Linear Demand function $D_x = a - bP_x$
 $= 10 - 2P_x$ is required function.

2080 Partial Q.No. 15 Let, demand function, $Q_d = 3000 - 50P$, supply function $Q_s = -1500 + 50P$.

- a. Determine equilibrium price and quantity and also compute price elasticity of demand.
b. Determine consumer's surplus, producer's surplus and total surplus. [4+6]

Ans: (a) 45, 750 (b) 562.5; 562.5; 1,125

$$Q_d = 3000 - 50P$$

$$Q_s = -1500 + 50P$$

$$\textcircled{a} \quad Q_d = Q_s$$

$$a. \quad 3000 - 50P = -1500 + 50P$$

$$a. \quad 3000 + 1500 = 50P + 50P$$

$$a. \quad 4500 = 100P$$

$$\therefore P = \frac{4500}{100}$$

$\therefore$ Equilibrium price level is Rs. 45

$\therefore$ Price Elasticity of Demand $E_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$

$$Q_d = 3000 - 50P$$

$$\frac{\Delta Q}{\Delta P} = \frac{dQ_d}{dP} \quad [\Delta Q \text{ and } \Delta P] \rightarrow \text{derivative}$$

$$\frac{d(3000 - 50P)}{dP}$$

$$\frac{d3000}{dP} - \frac{d50P}{dP}$$

$$= 0 - 50$$

$$= -50$$

$$\therefore E_p = -50 \times \frac{45}{750}$$

$\therefore$ Price Elasticity of Demand is Negative. $= -3$

And, then, Equilibrium Quantity

$$Q_d = 3000 - 50 \times 45$$

$$= 3000 - 2250$$

$$= 750 \text{ unit}$$

$$Q_s = -1500 + 50 \times 45$$

$$= -1500 + 2250$$

$$= 750 \text{ unit}$$

⑥ Consumer Surplus: Demand $\frac{Q}{P}$ $\frac{P}{Q}$

when
 $Q_d = 0$

$$\begin{aligned} \Rightarrow Q_d &= 3000 - 50P \\ 0 &= 3000 - 50P \\ \text{or } 3000 &= 50P \\ \therefore P &= 60 \end{aligned}$$

$$\begin{aligned} \# \text{ Consumer Surplus (CS)} &= \frac{1}{2} (P_i - P) \times Q \\ &= \frac{1}{2} (60 - 45) \times 750 \\ &= \text{Rs. } 5625 \end{aligned}$$

Producer Surplus (PS) = Supply $\frac{Q}{P}$ $\frac{P}{Q}$

$$\begin{aligned} \text{or } -1500 + 50P &= 0 \\ \text{or } 50P &= 1500 \\ \text{or } P &= 30 \end{aligned}$$

$$\begin{aligned} \text{Producer Surplus (PS)} &= \frac{1}{2} (P - P_i) \times Q_s \\ &= \frac{1}{2} \times (45 - 30) \times 750 \\ &= \text{Rs. } 5625 \end{aligned}$$

$$\begin{aligned} \# \text{ Total Surplus} &= \text{CS} + \text{PS} \\ &= 5625 + 5625 \\ &= \text{Rs. } 11250 \end{aligned}$$

Homework

8. Consider the following demand and supply functions:

$Q_d = 150 - 5P_x$; $Q_s = 10 P_x$

Answer the following questions:

- Graph the demand and supply equations and show the equilibrium price and quantity
- If demand increase to $Q_d = 150 - 10P_x$ and supply increase to $Q_s = 50 + 10P_x$, find out new equilibrium price and quantity. Also explain cause of change in equilibrium price and quantity.

Ans: (a) Rs. 10 and 100 units (b) Rs. 5 and 100

c. What is the nature of supply curve?

12. Let demand function, $Q_d = 300 - 5P$, supply function, $Q_s = -150 + 5P$. Determine consumer surplus, producer's surplus and total surplus.

Ans: 562.5; 562.5 and 1125

~~Homework~~

Unit 3 Elasticity of Demand & Supply – Theory

1. Define the Advertisement Elasticity of Demand.

Advertisement elasticity of demand measures the responsiveness of demand to a change in advertising expenditure.

विज्ञापन लोच भनेको विज्ञापन खर्चमा भएको परिवर्तनका कारण मागमा आउने परिवर्तनको मापन हो।

2. Write any two relationships between Price Elasticity of Demand and Marginal Revenue.

1. When demand is elastic ($E_d > 1$), Marginal Revenue (MR) is positive.
2. When demand is unitary elastic ($E_d = 1$), MR is zero.

1. माग लोचदार ($E_d > 1$) हुँदा सीमान्त आय (MR) धनात्मक हुन्छ।
2. माग एकात्मक लोचदार ($E_d = 1$) हुँदा सीमान्त आय (MR) शून्य हुन्छ।

4. List the Uses of Price Elasticity of Demand in Business Decision Making.

English:

- Pricing decision
- Production planning
- Sales forecasting
- Market expansion
- Advertisement policy
- मूल्य निर्धारण
- उत्पादन योजना
- बिक्री पूर्वानुमान
- बजार विस्तार
- विज्ञापन नीति

5. Let $E_{xy} = 4$ and $E_{AB} = -0.8$. Describe the nature of goods X, Y and A, B.

English:

- $E_{xy} = 4 \rightarrow X$ and Y are substitute goods.
- $E_{AB} = -0.8 \rightarrow A$ and B are complementary goods.
- $E_{xy} = 4 \rightarrow X$ र Y प्रतिस्थापन वस्तु हुन्।
- $E_{AB} = -0.8 \rightarrow A$ र B परिपूरक वस्तु हुन्।

6. Formula for Price Elasticity of Supply by Average (Arc) Method.

English:

$$E_s = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P} = \frac{P}{Q} \times \frac{\Delta Q}{\Delta P}$$

7. What is the Income Effect?

English:

Income effect is the change in quantity demanded due to a change in real income caused by a change in price.

मूल्य परिवर्तनका कारण वास्तविक आयमा आउने परिवर्तनले मागमा पार्ने प्रभावलाई आय प्रभाव भनिन्छ।

8. Let E_y (Mobile Set) = 2.3 and E_y (Potato) = -0.8. Describe the nature of these goods.

English:

- Mobile Set ($E_y = 2.3$): Luxury good
- Potato ($E_y = -0.8$): Inferior good

Nepali:

- मोबाइल सेट ($E_y = 2.3$): विलासितापूर्ण वस्तु
- आलु ($E_y = -0.8$): निम्नस्तरीय वस्तु

11. Uses of Price Elasticity of Demand in Business Decision Making.

English:

- Price fixation
- Revenue maximization
- Production planning
- Advertisement decision

- Market strategy

Nepali:

- मूल्य निर्धारण
- आय अधिकतमकरण
- उत्पादन योजना
- विज्ञापन निर्णय
- बजार रणनीति

$$D = S$$

Equilibrium price & quantity $D = S$

$$Q_{dx} = 100 - 5P_n$$

$$Q_{sx} = 30 + 5P_n$$

$$Q_{dx} = Q_{sx}$$

$$100 - 5P_n = 30 + 5P_n$$

$$\Rightarrow 100 - 30 = 5P_n + 5P_n$$

$$\Rightarrow 70 = 10P_n$$

$$P_n = 70/10 = 7$$

$$Q_{dx} = 100 - 5P_n$$

$$= 100 - 5 \times 7$$

$$= 65$$

12. 2081 Q.No. 14 Consider the following table:

दिइएको तालिका विचार गर्नुहोस्।

Price (Rs.)	$Q_{dx} = 100 - 5P_x$	$Q_{sx} = 30 + 5P_x$
5	$100 - 5 \times 5 = 75$	$30 + 5 \times 5 = 55$
6	$100 - 5 \times 6 = 70$	$30 + 5 \times 6 = 60$
7	$100 - 5 \times 7 = 65$	$30 + 5 \times 7 = 65$
8	$100 - 5 \times 8 = 60$	$30 + 5 \times 8 = 70$
9	$100 - 5 \times 9 = 55$	$30 + 5 \times 9 = 75$
10	$100 - 5 \times 10 = 50$	$30 + 5 \times 10 = 80$

a. Complete the table and determine equilibrium price and quantity.

तालिका पूरा गर्नुहोस् र सन्तुलित मूल्य र परिमाण निर्धारण गर्नुहोस्।

b. What will be the effect on equilibrium price and quantity when demand and supply functions increase to $Q_{dx} = 120 - 5P_x$ and $Q_{sx} = 40 + 5P_x$, respectively?

माग तथा आपूर्ति फलनहरू वृद्धि भई क्रमशः $Q_{dx} = 120 - 5P_x$ र $Q_{sx} = 40 + 5P_x$ सन्तुलित मूल्य र परिमाणमा कस्तो प्रभाव पर्दछ?

(10)

$$Q_{dx} = 120 - 5P_n$$

$$Q_{sx} = 40 + 5P_n$$

$$Q_{dx} = Q_{sx}$$

$$120 - 5P_n = 40 + 5P_n$$

$$\Rightarrow 80 = 10P_n$$

$$P_n = 8$$

$$D = S$$

$$Q_{dx} = 120 - 5 \times 8$$

$$= 120 - 40$$

$$= 80$$

$$Q_{sx} = 40 + 5P_n$$

$$= 40 + 5 \times 8$$

$$= 40 + 40$$

$$= 80$$

10

10. 2073 Q.No. 16 Complete the following schedule and answer the given questions. [4+2+4]

Combination	Commodity X	Commodity Y	MRS
A	1	15	—
B	2	$15 - 4 = 11$	-4
C	3	$11 - 3 = 8$	-3
D	4	$8 - 2 = 6$	-2
E	5	$6 - 1 = 5$	-1

From the given table, explain the marginal rate of substitution with the help of diagram.

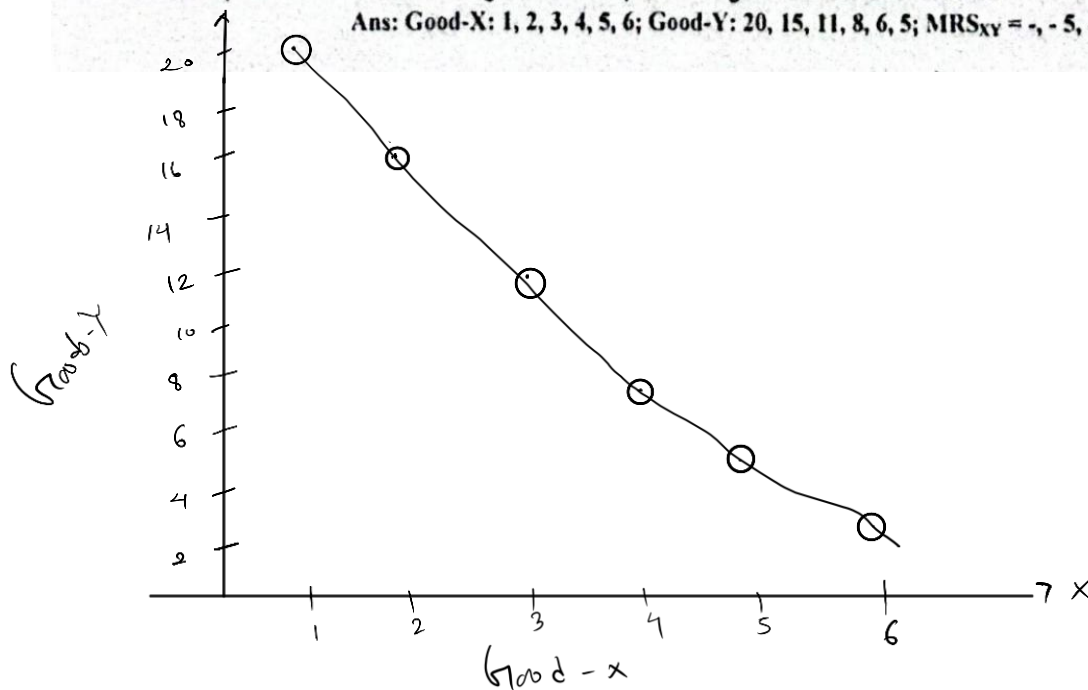
Ans: Commodity Y: 11, 8, 6, 5; MRS: -4, -3, -2, -1

11. Complete the following schedule and answer the given questions. [5+5]

Combinations	Good-X	Good-Y	MRS _{XY}
A	1	20	—
B	2	$20 - 5 = 15$	-5
C	3	$15 - 4 = 11$	-4
D	4	$11 - 3 = 8$	-3
E	5	$8 - 2 = 6$	-2
F	6	$6 - 1 = 5$	-1

Also represent the table in diagram and explain marginal rate of substitution.

Ans: Good-X: 1, 2, 3, 4, 5, 6; Good-Y: 20, 15, 11, 8, 6, 5; MRS_{XY} = -5, -4, -3, -2, -1



Marginal Rate of substitution:

The **Marginal Rate of Substitution (MRS)** is the rate at which a consumer is willing to give up one good in exchange for an additional unit of another good while maintaining the same level of satisfaction (utility).

Definition:

$$MRS_{xy} = -\frac{\Delta Y}{\Delta X}$$

where:

- XXX and YYY are two goods,
- ΔY is the amount of good YYY sacrificed,
- ΔX is the additional amount of good XXX obtained.

In simple terms:

It shows how many units of one good a consumer is willing to sacrifice to get one more unit of another good without changing their overall satisfaction.

Example:

If a consumer is willing to give up 2 cups of tea to get 1 more cup of coffee and remain equally satisfied, then:

$$MRS = 2$$

So, the marginal rate of substitution of coffee for tea is **2**.

Key Point:

MRS is equal to the **slope of an indifference curve** at a given point and usually **diminishes** as a consumer acquires more of one good and less of the other.

Unit - 5 ~~अर्थ~~ 2082 15 marks

17. 2082 Q.No. 17 The production function of Langtang Cheese Pvt. Ltd. is $Q = 4L + 11L^2 - L^3$. Complete the following table.

लाङटाङ चिज प्रा.लि.को उत्पादन फलन $Q = 4L + 11L^2 - L^3$ छ। दिइएको तालिका पूरा गर्नुहोस्।

No. of Labor	Total Production	Average Production	Marginal Production
0	0	-	-
1	$4 \times 1 + 11 \times 1^2 - 1^3 = 14$	14	14
2	$4 \times 2 + 11 \times 2^2 - 2^3 = 44$	22	30
3	$4 \times 3 + 11 \times 3^2 - 3^3 = 84$	28	40
4	$4 \times 4 + 11 \times 4^2 - 4^3 = 128$	32	44
5	$4 \times 5 + 11 \times 5^2 - 5^3 = 170$	34	42
6	$4 \times 6 + 11 \times 6^2 - 6^3 = 204$	34	34
7	$4 \times 7 + 11 \times 7^2 - 7^3 = 224$	32	20
8	$4 \times 8 + 11 \times 8^2 - 8^3 = 224$	28	0
9	$4 \times 9 + 11 \times 9^2 - 9^3 = 198$	22	-26

a. Analyze the three stages of the Law of Variable proportion for Langtang Cheese Pvt. Ltd. by using above data.

माथिको तथ्याङ्क प्रयोग गरी लाङटाङ चिज प्रा.लि.का लागि परिवर्तनशील अनुपातको नियमका तीनवटा चरणहरूको विश्लेषण गर्नुहोस्।

b. Market price of cheese is Rs. 1,000 per kg, and the wage rate is Rs. 34,000 per month. Using data of the second stage of the Law of Variable proportion, find the equilibrium level of labour and output of the cheese. (6+6+3)

चिजको बजार मूल्य प्रति केजी रु. १,००० छ, र ज्याला दर प्रति महिना रु. ३४,००० छ। परिवर्तनशील अनुपातको नियमको दोस्रो चरणको तथ्याङ्क प्रयोग गरी, श्रम र चिजको उत्पादनको सन्तुलनस्तर पत्ता लगाउनुहोस्।

Ans: (b) 6 units and 204 units

$$TP = 4L + 11L^2 - L^3$$

$$AP = TP/Q$$

① Analyze the three stages of the law of variable proportion for langtang cheese Pvt. Ltd.

stage 1: Increasing Return:

→ total production is increasing from 0 to 6 units of labour, that is 0 to 204 respectively and AP also increasing at 5 level of output and

maximum 34 at 6th level. MP is greater than AP.
This stage end when AP is maximum.

Stage II : Diminishing / constant Return:

→ TP constant at 7th level of labour to 8th level of labour. Whereby AP decline to 32 to 28 and MP also decline but remain at positive.

Stage III : Decreasing / Negative Return:

→ TP starts to decline at last stage of 8th unit of labour and MP becomes Negative, AP also decline.

⑥ market price of cheese (P) = Rs. 1000
labour rate (W) = Rs. 34,000

By using 2nd stage of law of variable proportion
 $VMP = MP \times P$

value of marginal product VMP

unit of labour

MP

$VMP = MP \times P$

0

-

$$14 \times 1000 = 14,000$$

1

14

$$30 \times 1000 = 30,000$$

2

30

$$40 \times 1000 = 40,000$$

3

40

$$44 \times 1000 = 44,000$$

4

44

$$42 \times 1000 = 42,000$$

5

42

$$34 \times 1000 = 34,000$$

6

34

$$20 \times 1000 = 20,000$$

7

20

0

8

0

Equilibrium level of labour is 6 unit

Equilibrium level of output is 204 units

TP of 6 unit = 204 unit

$$AY = A - B$$

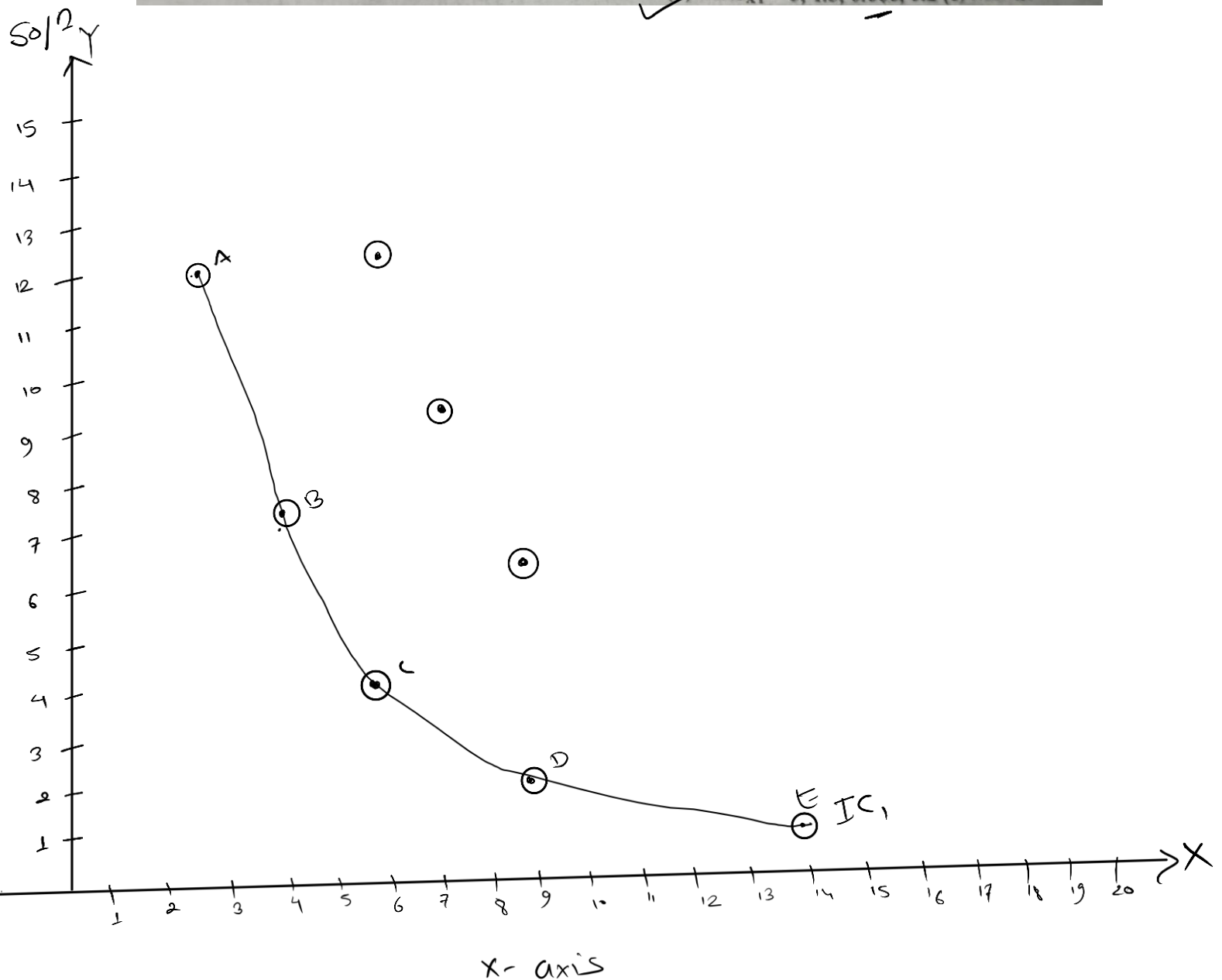
15. The following table gives four indifference schedules of an individual.

Combinations	IC ₁		IC ₂		IC ₃		IC ₄	
	Q _X	Q _Y	Q _X	Q _Y	Q _X	Q _Y	Q _X	Q _Y
A	3	12	6	12	8	15	10	13
B	4	7	7	9	9	12	12	10
C	6	4	9	6	11	9	14	8
D	9	2	12	4	15	6	18	7
E	14	1	15	3	19	5	20	6

- ✓ a. Using graph paper, plot the four indifference curves on the same set of axes. [4]
 ✓ b. Calculate the marginal rate of substitution of X for Y between the various points on IC₁. [3]
 ✓ c. What is MRS_{XY} at point C on IC₁? [3]

Ans: (b) MRS_{XY} = 5, 1.5, 0.666, 0.2 (c) MRS_{XY} = 0.666

Q



⑥ comp of marginal Rate of substitution (MRS) x for y on IC₁

$$MRS_{xy} = \frac{\Delta Y}{\Delta X}$$

Change in A and B

$$\Delta Y = 12 - 7 = 5$$

$$\Delta X = 4 - 3 = 1$$

$$MRS_{xy} = \frac{5}{1} = 5$$

Change in B and C

$$\Delta Y = 7 - 4 = 3$$

$$\Delta X = 6 - 4 = 2$$

$$MRS_{xy} = \frac{\Delta Y}{\Delta X} = \frac{3}{2} = 1.5$$

change c to D

$$\Delta Y = 4 - 2 = 2$$

$$\Delta X = 9 - 6 = 3$$

$$MRS_{xy} = \frac{\Delta Y}{\Delta X} = \frac{2}{3} = 0.666$$

change to D to E

$$\Delta Y = 2 - 1 = 1$$

$$\Delta X = 14 - 9 = 5$$

$$MRS_{xy} = \frac{\Delta Y}{\Delta X} = \frac{1}{5} = 0.2$$

MRS_{xy} IC₁ $\Rightarrow$ 5, 1.5, 0.666, 0.2

⑦ MRS_{xy} at point c in IC₁ is also 0.666 Ans!!!

~~1st~~

2nd Introduction

3rd AR, AC

4th Equilibrium

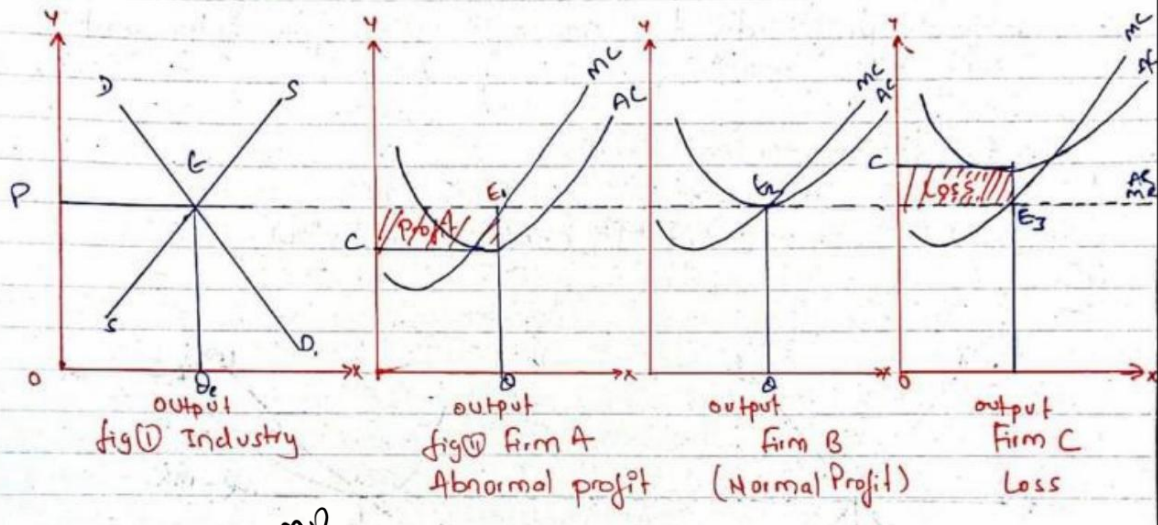
figure

5th Explain.

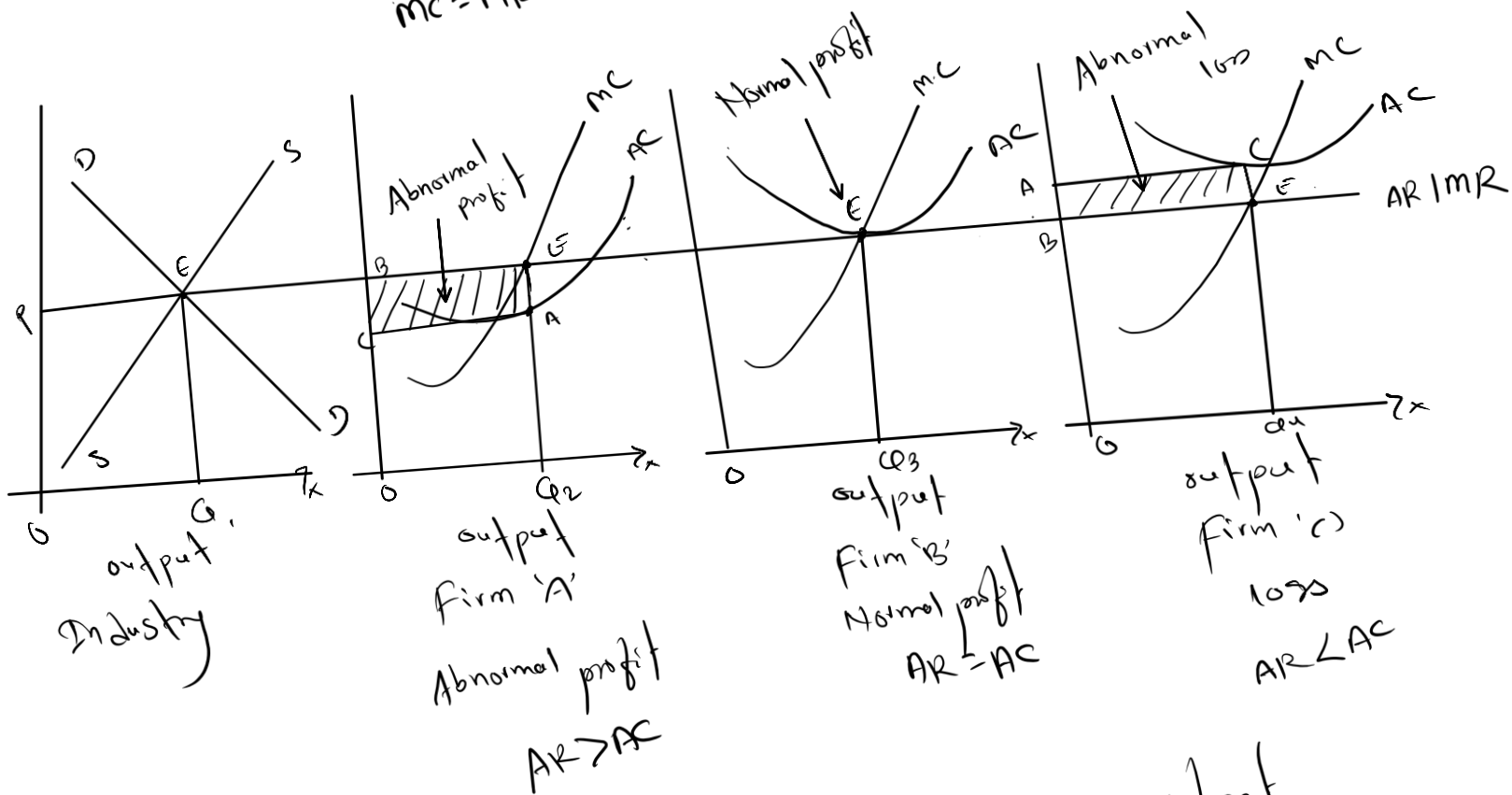
AR > AC, AR = AC, AR < AC
condition. MR = MC.

Perfect competition - short run Equilibrium

It can be further explained with the help of following figure:



$$MC = MR$$



$\therefore$ price & output determination under perfect competition short-run.

$$MR = MC$$

rief Answer Questions

[2 marks]

2077 Q.No. 8 Calculate the equilibrium level of output of the firm when marginal revenue is $MR = 300 - 0.002Q$ and marginal cost is $MC = 20 + 0.0008Q$.

Ans: 100,000 units

What level of profit will be obtained by the competitive firm at the condition of $MR = Rs.200$ and $AC = Rs.200$ in the long run.

Ans: Since in the long run $AC=AR=MC=MR=P$, the firm will just earn normal profit.

Calculate profit of the firm when $P = Rs.30$, $Q = 10$ units and $AC = Rs. 25$.

Ans: Rs.50

Fill up the following table

$$TR = P \times Q$$

Units of Output (Q)	Price (P)	Total Revenue (TR)	Total Cost (TC)	Profit (π)
1	10	10	5	5
2	9	18	12	6
3	8	24	18	6
4	7	28	22	6
5	6	30	30	0

Ans: $TR = 10, 18, 24, 28, 30$; Profit = 5, 6, 6, 6, 0

A firm's total revenue is Rs.2,000, its total cost is Rs.2,200 and its total fixed cost is Rs.1,000. Should the firm stay in business? Why?

Ans: $TVC = Rs. 1,200$

profit function
 $\pi = TR - TC$

Q.11

80/10

Given information:

$$MR = 300 - 0.002Q$$

$$MC = 20 + 0.0008Q$$

Under the equilibrium level $MR = MC$ [Perfect Competition]

$$\text{or, } 300 - 0.002Q = 20 + 0.0008Q$$

$$\text{or, } 300 - 20 = 0.0008Q + 0.002Q$$

$$\text{or, } 280 = 0.0028Q$$

$$\text{or, } Q = \frac{280}{0.0028}$$

$$\therefore \text{output} = 1,00,000 \text{ units}$$

Ans

Descriptive Answer Questions

[10 marks]

2082 Q.No. 16 Complete the following table. Graph total revenue, average revenue and marginal revenue curves. Explain the relation of total revenue and marginal revenue with price elasticity of demand. (2+3+5)

दिइएको तालिका पूरा गर्नुहोस् । कुल आय, औसत आय र सिमान्त आय वक्रहरूको ग्राफ बनाउनुहोस् । मागको मूल्यलोचसँग कुल आय र सिमान्त आयको सम्बन्ध व्याख्या गर्नुहोस् ।

90 Asmita's Question Bank- BBS First Year

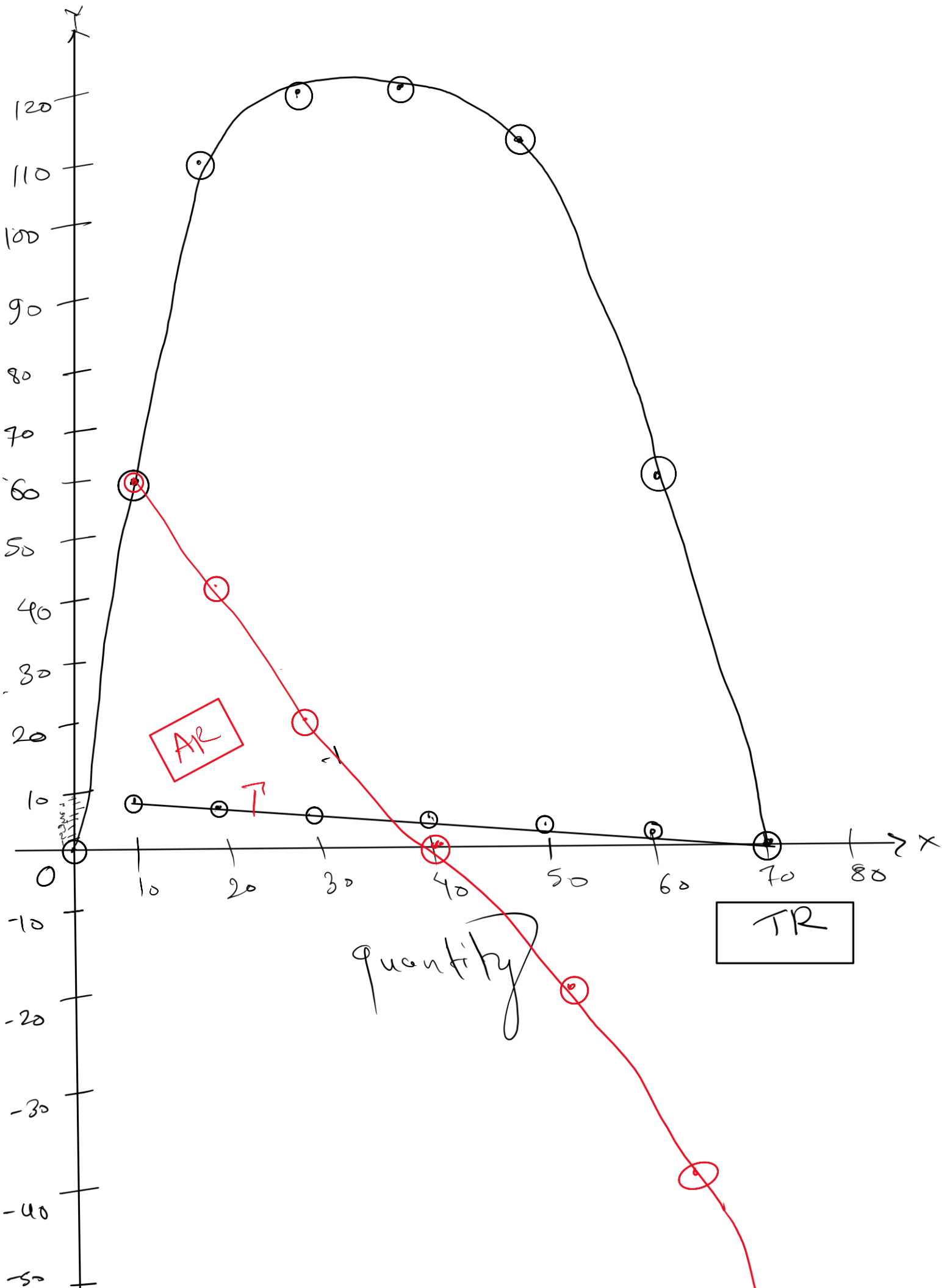
Quantity	0	10	20	30	40	50	60	70
Total revenue	0	60	100	120	120	100	60	0
Average revenue								
Marginal revenue								

2082
For completing the table

$$AR = \frac{TR}{Q}$$

Quantity (Q)	Total Revenue (TR)	Average Revenue (A.R)	Marginal Revenue (MR)
0	0	—	—
10	60	6	60
20	100	5	40
30	120	4	20
40	120	3	0
50	100	2	-20
60	60	1	-40
70	0	0	-60

The Above table shows in graph in below ---



Then,
Relationship between TR and MR with elasticity of demand.

- ① When Demand Elastic $E_D > 1$
 - ① TR increased
 - ② MR positive
 - ③ price will increase in TR
- ② When Demand is unitary Elastic $E_D = 1$
 - ① TR maximize
 - ② MR become Zero
 - ③ Further No increase in TR
- ③ When Demand is Inelastic $E_D < 1$
 - ① Total Revenue Decrease
 - ② MR is Negative

$$MR = AR \left(\frac{E_D - 1}{E_D} \right)$$

