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IIT JAM ECONOMICS:
NUMBER OF QUESTIONS ASKED IN PREVIOUS EXAMS (2021-2026)

Micro Economics		2021	2022	2023	2024	2025	2026
1.1	Consumer Theory	4	3	4	6	6	5
1.2	Theory of Production & Cost	5	7	-	7	4	5
1.3	General Equilibrium & Welfare	-	1	3	1	1	2
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CHAPTER-1 MICRO ECONOMICS

Unit 1.1: Consumer Theory:

MCQ (Multiple Choice Questions)

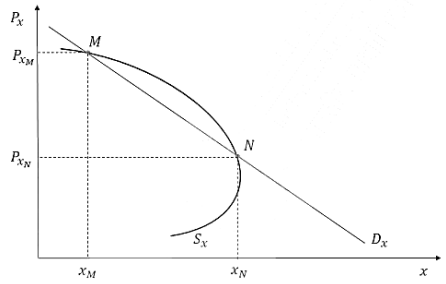
[2021: 1 Mark]

1. You have a budget of Rs.4000 and would like to purchase LPG cylinders from a local seller who charges Rs.50 per cylinder. The seller has a subsidy scheme by which if you return the empty cylinder purchased from him, you will get a refund of Rs.20 per cylinder. You cannot borrow money from anyone. The maximum number of cylinders you can purchase is

(A) 131 (B) 132
(C) 133 (D) 134

[2022: 1 Mark]

2. When the supply curve S_x is backward bending and the demand curve D_x is downward sloping as shown in the figure, there are two equilibria M and N respectively which of the following statements is CORRECT?



(A) Only *M* is stable equilibrium
(B) Only *M* is stable equilibrium
(C) Both *M* and *N* are stable equilibria
(D) Both *M* and *N* are unstable equilibria

[2022: 2 Mark]

3. An analyst at the Green Car Co. Ltd. estimated the following demand function for electric vehicles it sells: $Q_E = 0.75 - 1.5P_E + 2.5P_F - 0.5P_B + 3.21$ where Q_E −Number of electric vehicles (in thousand per year), P_E Unit logy Roorkee vehicle (Rs. in Lakh), P_F, = Average unit price of vehicle using fossil fuels (Rs. in Lakh), P_B = Unit price of battery used in electric vehicle (Rs. in Lakh), I income (Rs. in Lakh).

Let $P_E = Rs.$ 6.5 Lakh, P_F = Rs. 4.5 Lakh, P_B = $Rs\ 0.5$ lakh and *I* = Rs.10 Lakh than the income elasticity of demand $(eq_E I)$ and the cross price elasticity of demand $(eq_E p_F)$ satisfy

(A) $0.98\ eqgI \leq 0.99\ and\ 0.33 \leq e_{q_E p_F} \leq 0.34$
(B) $0.94\ eqgI \leq 0.95\ and\ 0.45 \leq e_{qEpF} \leq 0.46$
(C) $0.98\ eqgI \leq 0.99\ and\ 0.45 \leq e_{QEPF} \leq 0.46$
(D) $0.94 < e_{QEI} \leq 0.95\ and\ 0.33 \leq e_{q_E p_F} \leq 0.34$

[2024: 1 Mark]

4. Let x and y be two consumption bundles, assumed to be non-negative and perfectly divisible. Further, the assumptions of completeness, transitivity, reflexivity, non-satiation, continuity, and strict convexity are satisfied.

Then, which of the following statements is NOT CORRECT?

(A) Either $x \succsim y$, or $y \succsim x$, or both
(B) $y \succ x$ if y contains more of at least one good and no less of any other
(C) x is not indifferent to itself
(D) For $x\ (or\ y)$, its better set is strictly convex

[2024: 2 Mark]

5. For a profit maximising monopolist, the ratio of the profit margin to price (also known as the Lerner Index or the relative mark-up) has a relationship with the price-elasticity of demand at the profit maximising price. Then, which of the following statements is CORRECT?

(A) The larger the elasticity of demand at the profit maximising price, the greater is the relative mark-up
(B) The power to sustain a price higher than the marginal cost depends only on the profit maximising price
(C) At the profit maximising price, given costs are greater than zero, the price elasticity of demand is strictly larger than unity
(D) At the revenue maximising price, the price elasticity of demand is greater than unity

[2024: 2 Mark]

6. Suppose the price elasticity of demand (e_D) is $-\frac{1}{5}$ and the price elasticity of supply (e_S) is $\frac{2}{5}$. Then, the incidence of a specific (or unit) tax on the firms is equal to

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$
(C) $\frac{1}{2}$ (D) $\frac{1}{4}$

[2025: 2 Mark]

7. Consider a consumer with the utility function, $U(x,y) == y + \sqrt{x}$ where x and y are quantity of two commodities consumed.
Which one of the following is TRUE?
(A) Income elasticity of demand for both goods is 1.
(B) Income elasticity of demand for good x is 0.
(C) Income elasticity of demand for good y is 0.
(D) Income elasticity of demand for good x is 0.5 and good y is 1.

[2025: 2 Mark]

8. In a two-goods consumption framework, Engel curve shows the relationship between _____ .
(A) price of one good and quantity demanded of the other good
(B) relative price of the goods and ratio of their quantities demanded
(C) income and quantity demanded of one of the goods
(D) income and the ratio of quantities demanded of the two goods

[2025: 2 Mark]

9. Theory of revealed is used to derive _____.
(A) optimal choice, using incomes, prices, and preference
(B) level of income, using prices, preference, and optimal choice information
(C) preference, using prices, incomes, and optimal choice information
(D) prices, using preference, incomes, and optimal choice information

[2025: 2 Mark]

10. You are measuring level of consumption of a good commodity on the X-axis and that of a bad commodity on the Y-axis. The indifference curve is _____.
(A) parallel to the X-axis
(B) parallel to the Y-axis
(C) of "inverted-U" shape
(D) having a positive slope

[2025: 2 Mark]

11. Marginal utility of a good refers to the _____.
(A) change in utility by consuming the good
(B) change in utility by consuming some additional units of the good
(C) rate of change in utility from per unit change in consumption of the good
(D) rate of change in utility from per unit monetary change in expenditure on the good

(2026: 1 Marks)

12. Let e, R, and p represent own price elasticity of demand, total revenue, and price, respectively for a good. If $\frac{\partial R}{\partial p} < 0$, then
(A) $|e| > 1$ (B) $|e| = 1$
(C) $|e| < 1$ (D) $|e| = 0$

(2026: 2 Marks)

13. Consider the statements I, II, and III:
I. Income elasticity of demand for a normal good is positive.
II. Income elasticity of demand for an inferior good is negative.
III. Income elasticity of demand for a luxury good is less than 1.
Which one of the following options is CORRECT?
(A) Both II and III are NOT CORRECT, but I is CORRECT
(B) Both II and III are CORRECT, but I is NOT CORRECT
(C) Both I and III are CORRECT, but II is NOT CORRECT
(D) Both I and II are CORRECT, but III is NOT CORRECT

(2026: 2 Marks)

14. Consider a demand curve represented as $q^a p^b = c$, where q is the quantity demanded, p is the per unit price, and a, b, and c are all positive constants. The absolute value of the own price elasticity of demand is
(A) b/a (B) a/b
(C) b (D) a

MSQ (Multiple Select Questions)

[2022: 2 Mark]

1. The demand function (Q_x^D) and supply function (Q_x^S) are given as:
$Q_x^D = f(P_x, I)$ *and* $Q_x^S = g(P_x, A)$
where I (Income) and A (Advertisement expenses) are the exogenous factors quantity demanded and supplied, respectively. Further $\frac{\partial f}{\partial p_x} < 0$, $\frac{\partial g}{\partial p_x} > 0$ *but* $\frac{\partial f}{\partial l}$ and $\frac{\partial g}{\partial A}$ may have any sign. Considering that there exists an equilibrium $(Q_x^D = Q_x^S = Q)$.
Which of the following is/are CORRECT?
(A) $e_{pxA} = \left(\frac{\partial g}{\partial A}.\frac{A}{Q}\right) / \left(\frac{\partial f}{\partial p_x}\frac{p_x}{Q} - \frac{\partial g}{\partial p_x}\frac{p_x}{Q}\right)$
(B) $\frac{dp_x}{dA} = \left(\frac{\partial g}{\partial A}\right) / \left(\frac{\partial f}{\partial p_x} - \frac{\partial g}{\partial p_x}\right)$
(C) $e_{pxl} = \left(\frac{\partial g}{\partial l}\frac{I}{Q}\right) / \left(\frac{\partial f}{\partial p_x}\frac{p_x}{Q} - \frac{\partial g}{\partial p_x}\frac{p_x}{Q}\right)$
(D) *The sign of* $\frac{\partial p_x}{dA}$ *does not depend on* $\frac{\partial g}{\partial A}$

[2023: 2 Mark]

2. Suppose that the utility function $u: \mathbb{R}_+^n \to \mathbb{R}_+$ represents a complete, transitive and continuous preference relation over all bundles of n goods.

Then select the choices below in which the function also represents the same preference relation.

(A) $f(x_1, x_2, \dots, x_n) = u(x_1, x_2, \dots, x_n) + \left(u(x_1, x_2, \dots, x_n)\right)^3$

(B) $g(x_1, x_2, \dots, x_n) = u(x_1, x_2, \dots, x_n) + \sum_{i=1}^{n} x_i$

(C) $h(x_1, x_2, \dots, x_n) = \left(u(x_1, x_2, \dots, x_n)\right)^{\frac{1}{n}}$

(D) $m(x_1, x_2, \dots, x_n) = u(x_1, x_{26} \cdot x_n) + (x_1^2 + x_2^2 + \cdots + x_n^2)^{0.5}$

[2024: 2 Mark]

3. **Consider the following three utility functions:**

$F = (4x_1, 2x_2) and$

$H = \sqrt{x_1} + x_2$

$G = min(4x_1 + 2x_2)$

where, x_1 and x_2 are two goods available at unit prices Px_1 and Px_2, respectively Which of the following is/are CORRECT for the above utility functions?

(A) The marginal rate of substitution is given by $-1, -2, and -0.5\sqrt{x_1}$ for the utility functions F, G, and H, respectively

(B) If $p_{x_1} = p_{x_2}$, then the utility maximisation problem with utility function F has a corner solution

(C) If income is 100 and $p_{x_1} = p_{x_2} = 2$, then in the utility maximisation problem with utility function G, the sum of the optimal values of x_1 and x_2 is 50

(D) If income is $100, p_{x_1}, = 5$, and $p_{x_2} = 5000$, then in the utility maximisation problem with the utility function H, the optimal value of x_2 is 20

NAT (Numerical Answer Type)

[2021: 1 Mark]

1. **A consumer always spends 50% of his monthly income on food. Introduction of value added tax on food items has led to a 20% increase in food prices while his monthly income remained unchanged. The consumer's price elasticity of demand for food is__. (in integer)**

[2021: 1 Mark]

2. **The utility function of a consumer from consumption of x_1 and x_2 is given by $u(x_1, x_2) = x_1 + 2\sqrt{x_2}$. At the current prices and income, the consumer's optimal consumption bundle is given by $(x_1 = 10, x_2 = 10)$. The consumer's optimal choice of x_2, if his income increases by 50% but prices remain unchanged, is_____. (in integer)**

[2021: 2 Mark]

3. **Amar has an endowment of food $F_A = 2$ and water $W_A = 5$. Barun has an endowment of food $F_B = 8$ and water $W_B = 5$. Amar's utility function is given by $U_A(f_A, w_A) = f_A^2 w_A$; where f_A and w_A are his consumption of food and water, respectively. Barun's utility function is given by $U_B(f_B, w_B) = min\{f_B, w_B\}$; where f_B and w_B are his consumption of food and water respectively. They exchange food and water at prices p_f and p_w respectively, to maximize their utilities. In the competitive equilibrium, $\frac{p_f}{p_w}$ equals ____. (in integer)**

[2023: 1 Mark]

4. **A firm has production function $y = K^{0.5}L^{0.5}$ and faces wage rate $w = 4$ and rental rate of capital $r = 4$. The firm's marginal cost is equal to _____ (in integer).**

[2023: 2 Mark]

5. **A consumer has utility function $u(x_1, x_2) = \max\{0.5x_1, 0.5x_2\} + \min\{x_1, x_2\}$. She has some positive income y, and faces positive prices p_1, p_2 for goods 1 and 2 respectively. Suppose $p_2 = 1$. There exists a lowest price $\overline{p_1}$ such that if $p_1 > \overline{p_1}$ then the unique utility maximizing choice is to buy ONLY good 2. Then $\overline{p_1}$ is _____ (in integer).**

[2023: 2 Mark]

6. **In a two period model, a consumer is maximizing the present discounted utility $W_t = \ln(c_t) + \frac{1}{1+\theta}\ln(c_{t+1})$ with respect to c_t and c_{t+1} and subject to the following budget constraint $c_t + \frac{c_{t+1}}{1+r} \leq y_t + \frac{y_{t+1}}{1+r}$ where c_i and y_i are the consumption and income in period $i(i = t, t+1)$ respectively, $\theta \in [0, \infty)$ is the time discount rate and $r \in [0, \infty)$ is the rage of interest. Suppose, consumer is in the interior equilibrium and $\theta = 0.05$ and $r = 0.08$. In equilibrium, the ratio $\frac{c_{t+1}}{c_t}$ is equal to _____. (round off to 2 decimal places).**

[2024: 1 Mark]

7. **Let an inverse demand function for a commodity be $p = e^{-\frac{x}{2}}$, where x is the quantity and p is the price. Then, at p = 0.5, the consumer surplus is equal to_____. (*rounded off to two decimal places*).**

[2024: 1 Mark]

8. **A consumer's utility function is given by: $u(x_1, x_2) = (2x_1 - 1)^{0.25}(x_2 - 4)^{0.75}$ If the consumer has a budget of 73 and the unit prices of x_1 and x_2 are given by 2 and 1, respectively, then the value of $(x_1 + x_2)$ is___.(*rounded off to two decimal places*).**

[2025: 1 Mark]

9. **Suppose utility function of a consumer is $u(x,y) = xy$, where x and y are quantities of the two commodities consumed.**
   If price of x is Re.1 and that of y is Rs.2, and income of the consumer is Rs.100, utility maximizing quantity consumption of x is _____.

(2026: 1 Marks)

10. **The utility function of a consumer in a two-good world is given by $u(x_1,x_2) =$ minimum $\{x_1,x_2\}$, where x_1 and x_2 are the quantities consumed of the two goods X_1 and X_2, respectively. The market prices of X_1 and X_2 are Rupee 1 and Rupees 2 per unit, respectively. Assuming income is measured on the vertical axis, the slope of the Engel curve for X_2 is ___ (in integer).**

(2026: 2 Marks)

11. **In a two-good world, the utility function of a consumer is given by $u(x_1,x_2) = x_1x_2$, where x_1 and x_2 are the quantities consumed of the two goods X_1 and X_2, respectively. The market price of each of the goods is Rupee 1 and consumer's disposable income is Rupees 100. If the price of X_2 is doubled keeping the price of X_1 unchanged, then the associated Compensating Variation is Rupees ___ (rounded off to one decimal place).**

ANSWER KEY

MCQ (Multiple Choice Question)

1	2	3	4	5	6
(B)	(B)	(D)	(C)	(C)	(A)
7	**8**	**9**	**10**	**11**	12
(B)	(C)	(C)	(D)	(C)	(A)
13	**14**				
(D)	(A)				

MSQ (Multiple Select Question)

1	2	3
(A,B)	(A,C)	(B,C)

NAT (Numerical Answer Type)

1	2	3	4	5	6
(-1)	(10)	(2)	(8 to 8)	(2 to 2)	(1.02 to 1.04)
7	**8**	**9**	**10**	**11**	
(0.30 to 0.32)	(64 to 64)	(50)	(3)	(41.4)	

EXPLANATION

MCQ (Multiple Choice Questions)

1. **Correct Answer is (B):** To determine the maximum number of LPG cylinders we can purchase, let's analyze the situation.
   The seller charges Rs.50 per cylinder and provides a refund of Rs.20 for each empty cylinder returned. Thus, the net cost of one cylinder is:
   "Net Cost"=50-20=30 "Rs. (for cylinders purchased after the first purchase)".
   However, for the first purchase, the cost is Rs.50 as there is no empty cylinder to return.
   We have Rs.4000, and your budget will reduce by Rs.50 for the first cylinder and Rs.30 for subsequent cylinders.
   For the first cylinder, you pay Rs.50, leaving 4000-50=3950 Rs.
   For subsequent cylinders, each cylinder costs Rs.30.
   The number of subsequent cylinders you can purchase with Rs.3950 is:
   "Number of subsequent cylinders"=3950/30=131.67.
   Since the number of cylinders must be an integer, you can buy 131 cylinders after the first one.
   The total number of cylinders purchased is: 1+131=132.

2. **Correct Answer is (B):** The diagram shows a backward-bending supply curve (S_X) and a downward-sloping demand curve (D_x) with two intersections, M and N, which are the two equilibria.
   To determine the stability of the equilibria:

1. **Stability of an Equilibrium:**
   An equilibrium is **stable** if, when the market is slightly disturbed, the forces of supply and demand return the price and quantity to the equilibrium point.
   It is **unstable** if any small disturbance pushes the system further away from the equilibrium.

2. **Analysis of Equilibria M and N:**
   At equilibrium M: To the left of M, an increase in price reduces the excess demand, causing the market to return to M.
   To the right of M, a decrease in price reduces the excess supply, causing the market to return to M.
   Hence, M is a **stable equilibrium**.
   At equilibrium N:
   To the left of N, a price increase creates excess demand, moving the system further away from N.
   To the right of N, a price decrease creates excess supply, moving the system further away from N.

Hence, N is an **unstable equilibrium**.
(A) Only M is a stable equilibrium.

3. Correct Answer is (D): Given: $Q_E = 0.75 - 15P_E + 2.5P_F - 0.5P_B + 3I$ Where $P_E = 6.5, P_E = 4.5, P_B = 0.5, I = 10$
Put these Values, we get
$Q_E = 0.75 - 15(6.5) + 2.5(4.5) - 0.5(0.5) + 3(10)$
$Q_E = 0.75 - 9.75 + 11.25 - 0.25 + 30$
$Q_E = 32$
Now, Income Elasticity of demand (e_{qE}, I):
$(e_{qE}, I) = \frac{\partial Q_E}{\partial I} . \frac{I}{Q_E}$
Now $\frac{\partial Q_E}{\partial I} = 3$
$\Rightarrow (e_{qE}, I) = \frac{3.10}{32} = \frac{30}{32} = 0.9375$
Thus (e_{qE}, I) lies between 0.94 and 0.95
Now, Cross Price elasticity of demand (e_{qE}, P_F) :
$(e_{qE}, P_F) = \frac{\partial Q_E . P_E}{\partial P_F \ Q_E}$
$\frac{\partial Q_E}{\partial P_F} = 2.5$
Now $(e_{qE}, P_F) = \frac{2.5(4.5)}{3.2} = 0.3515625$
Thus, (e_{qE}, P_F) lies between 0.33 and 0.34.
Thus, correct answer is:-
(D) $0.94 < eq_E, I \leq 0.95$ and $0.33 \leq e_{qE,} P_E \leq 0.34$

4. Correct Answer is (C):

1. **Option (A)**: Either x≥y, or both is **correct** because the assumption of completeness ensures that any two bundles x and y can be compared.
2. **Option (B)**: y≻x if y contains more of at least one good and no less of any other is **correct** due to the assumption of non-satiation, which implies "more is better."
3. **Option (C)**: x is not indifferent to itself is **NOT correct** because the assumption of reflexivity states that any bundle is at least as good as itself (x∼x).
4. **Option (D)**: For x (or y, its better set is strictly convex is **correct** due to the assumption of strict convexity, implying that consumers prefer averages of bundles over extremes.

Thus, the statement in **Option (C)** contradicts the assumption of reflexivity.

5. Correct Answer is (C): Lerner Index= $\frac{P-MC}{P} = \frac{-1}{E_d}$
Where:
P = Price,
MC = Marginal Cost,
E_d= Price elasticity of demand (absolute value).
For a profit-maximizing monopolist:

1. The price-elasticity of demand (E_d) must be **strictly greater than 1** (elastic demand).
2. The relative mark-up (L) decreases as elasticity (E_d) increases.

Options:

(A) The larger the elasticity of demand at the profit maximising price, the greater is the relative mark-up:
From the formula L=$\frac{-1}{E_d}$, we see that as E_d increases, the relative mark-up (L) **decreases**, not increases.
This statement is **incorrect**.

(B) The power to sustain a price higher than the marginal cost depends only on the profit maximising price:
The ability to sustain a price above marginal cost depends not only on the profit-maximizing price but also on the elasticity of demand. If demand is highly elastic, the ability to charge a price above marginal cost diminishes.
This statement is **incorrect.**

(C) At the profit maximising price, given costs are greater than zero, the price elasticity of demand is strictly larger than unity:
For a monopolist to maximize profit, marginal revenue (MR) equals marginal cost (MC). Since MR=P(1−$\frac{1}{E_d}$), and MR>0 at the profit-maximizing point, we require:
1−$\frac{1}{E_d}$>0 ⟹Ed>1
This is **correct**, as the price elasticity of demand must strictly exceed unity at the profit-maximizing price.

(D) At the revenue maximising price, the price elasticity of demand is greater than unity:
At the revenue-maximizing price, marginal revenue equals zero. Using the formula MR= P(1−$\frac{1}{E_d}$)=0 ⟹Ed =1.
This is **incorrect**, as at the revenue-maximizing price, the price elasticity of demand is exactly unity, not greater than unity.

6. Correct Answer is (A): Given $e_d = \frac{-1}{5}, e_S = \frac{2}{5}$
We know that Incidence on firms $= \frac{ed}{e_d + e_S}$
For simplicity, we will take absolute value of $e_d = 1/5$
Now, Incidence on firms $= \frac{1/5}{1/5+2/5} = \frac{1/5}{3/5} = \frac{1}{3}$

7. Correct Answer is (B): The utility function given is:
$$U(x, y) = y + \sqrt{x}$$
Here, **x** and **y** are the quantities of two goods consumed.
To understand the income elasticity of demand for each good, we need to analyze the consumer's

demand for these goods in response to changes in income.

To find the demand functions, we need to determine the optimal consumption bundle using the **utility maximization** approach, subject to the consumer's budget constraint.

Let the consumer's budget be **I**, with prices p_x for good **x** and p_y for good **y**. The budget constraint is:

$$p_x \cdot x + p_y \cdot y = I$$

To maximize utility $U(x, y) = y + \sqrt{x}$, we calculate the **marginal utility** for each good:

- Marginal utility of **x**: $\frac{\partial U}{\partial x} = \frac{1}{2\sqrt{x}}$
- Marginal utility of **y**: $\frac{\partial U}{\partial y} = 1$

The optimal consumption of **x** and **y** will depend on the marginal utilities and the prices of the goods. Solving for the optimal quantities of **x** and **y**, we get the demand functions.

For **x**:

$$x = \left(\frac{I}{2p_x}\right)^2$$

This shows that the demand for **x** is **independent of income**. As income increases, the demand for **x** does not change (since it is not linear in income), meaning the **income elasticity of demand for good x is 0**.

For **y**:

$$y = \frac{I}{p_y}$$

This shows that the demand for **y** is **directly proportional to income**, meaning that the **income elasticity of demand for good y is 1**.

The income elasticity of demand is given by:

$$E_I = \frac{\%\text{ change in demand}}{\%\text{ change in income}} = \frac{dQ}{Q} \times \frac{I}{dI}$$

- **Income elasticity for good x**: Since the demand for **x** does not depend on income, the income elasticity of demand for **x** is **0**.
- **Income elasticity for good y**: Since the demand for **y** is linear in income, the income elasticity of demand for **y** is **1**.

Conclusion:

- The income elasticity of demand for **good x is 0** (since demand does not change with income).
- The income elasticity of demand for **good y is 1** (since demand is directly proportional to income).

Thus, the correct answer is **(B)**.

8. Correct Answer is (C): An **Engel curve** shows the relationship between a consumer's **income** and the **quantity demanded of one good**. It illustrates how the demand for a specific good changes as the consumer's income changes, holding other factors constant.

- **Engel Curve** is used to analyze how the consumption of a good changes when income changes, helping to identify whether a good is a **normal good** (demand increases as income rises) or an **inferior good** (demand decreases as income rises).

Why the other options are incorrect:

(A) The Engel curve does not show the relationship between the price of one good and the quantity demanded of the other good. That would relate to a **demand curve** for each good.

(B) The Engel curve does not show the relationship between relative prices and the ratio of quantities demanded. This would relate to the **budget constraint** or **price ratio** in consumer theory.

(D) The Engel curve is concerned with the demand for a **single good**, not the ratio of quantities demanded for both goods. That would relate to the **Indifference curve analysis**.

Therefore, **(C)** is the correct answer.

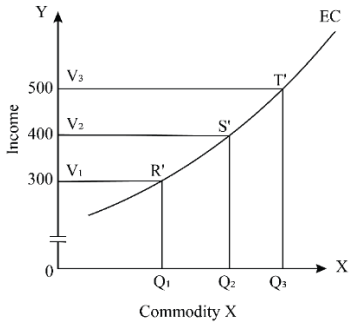


Diagram: Engel Curve (EC)

9. Correct Answer is (C): The **Theory of Revealed Preference**, developed by economist **Paul Samuelson**, is used to infer a consumer's preferences based on their observed choices, given their income and the prices of goods. According to this theory, if a consumer chooses one bundle of goods over another when both are affordable, we can "reveal" their preference for the chosen bundle.

In other words, **revealed preference theory** allows us to derive the consumer's preferences indirectly by observing their behavior (i.e., their optimal choices) under various price and income conditions. It focuses on how consumers make choices, and from those choices, we can infer their preferences without directly asking them about their utility or satisfaction.

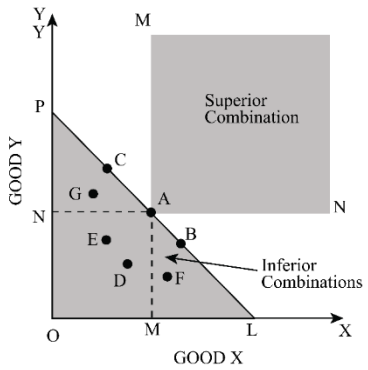


Diagram: Choice reveals Preference

10. Correct Answer is (D): When measuring the level of consumption of a good commodity on the X-axis and that of a bad commodity on the Y-axis, the indifference curve typically has a positive slope. This is because consuming more of a bad commodity decreases utility, so to maintain the same level of satisfaction, an increase in the consumption of the bad commodity (Y-axis) must be compensated by an increase in the consumption of the good commodity (X-axis).

So, the correct answer is: (D) having a positive slope

11. Correct Answer is (C): Marginal utility of a good refers to the rate of change in utility from a per unit change in the consumption of the good. It measures how much additional satisfaction or utility a consumer gains from consuming one more unit of the good.

So, the correct answer is: (C) rate of change in utility from per unit change in consumption of the good

12. Correct Answer is (A):

Total Revenue, $R = p \times q$, where p = price and q = quantity demanded.

Differentiate with respect to p:

$$\frac{\partial R}{\partial p} = q + p\frac{\partial q}{\partial p}$$

Given:

$$\frac{\partial R}{\partial p} < 0$$

So,

$$q + p\frac{\partial q}{\partial p} < 0 \ldots (\mathrm{i})$$

Own-price elasticity of demand is

$$e = \frac{\partial q}{\partial p}\frac{p}{q}$$

Therefore,

$$p\frac{\partial q}{\partial p} = eq \ldots (\mathrm{ii})$$

Substitute (ii) in (i), we get,

$$q + eq < 0$$
$$q(1 + e) < 0$$

Since $q > 0$,

$$1 + e < 0$$
$$e < -1$$

Therefore,

$$|e| > 1$$

13. Correct Answer is (D):

Statement I: For a normal good, quantity demanded rises as income rises, so income elasticity is positive. **Correct.**

Statement II: For an inferior good, quantity demanded falls as income rises, so income elasticity is negative. **Correct.**

Statement III: A luxury good is defined by income elasticity greater than 1 (demand grows more than proportionally with income), not less than 1. A good with income elasticity between 0 and 1 is a necessity, not a luxury.

So, this statement is **incorrect.**

14. Correct Answer is (A):

The demand curve is:

$$q^a p^b = c$$

Taking logarithms on both sides:

$$a\ln q + b\ln p = \ln c$$

Since c is constant, differentiate with respect to $\ln p$:

$$a\frac{d\ln q}{d\ln p} + b = 0$$

Therefore,

$$\frac{d\ln q}{d\ln p} = -\frac{b}{a}$$

Own-price elasticity of demand is:

$$e = \frac{d\ln q}{d\ln p} = -\frac{b}{a}$$

Hence, its absolute value is:

$$|e| = \frac{b}{a}$$

MSQ (Multiple Select Questions)

1. Correct Answer is (A and B): Given demand function and Supply function:

$Q_x^D = f(Px, I)$, $Q_x^S = g(Px, A)$ where I = Income, A Advertisement Expenses.

Also $\frac{\partial f}{\partial Px} < 0, \frac{\partial g}{\partial Px} > 0$

Equilibrium will be achieved at:-

$Q_x^D = Q_x^S = Q$

Option A:-

$$eP_xA = \frac{\frac{\partial 8}{\partial A}}{\frac{\partial F}{\partial P_x}} \frac{\frac{A}{Q}}{\frac{P_x}{Q} - \frac{\partial 8}{\partial P_x}\frac{P_x}{Q}}$$

This is a **correct** formula for the elasticity of price with respect to advertisement expenses.

Option B: $\frac{dp_x}{dA} = \left(\frac{\partial g}{\partial A}\right) / \left(\frac{\partial f}{\partial p_x} - \frac{\partial g}{\partial p_x}\right)$

This is also **correct** for the rate of change of price with respect to advertisement expenses.

Option C : $e_{p_x} I == \frac{\frac{\partial 8}{\partial I}}{\frac{\partial F}{\partial P_x}} \frac{\frac{I}{Q}}{\frac{P_x}{Q} - \frac{\partial 8}{\partial P_x}\frac{P_x}{Q}}$

This is **incorrect.** The elasticity should involve change in income (I), but $\frac{\partial 8}{\partial I}$ is not defined in the problem, as supply is not a function of income

Option D: The sign of $\frac{dP_x}{d_A}$ depends on $\frac{\partial 8}{\partial A}$

This is incorrect because $\frac{\partial Px}{\partial A}$ explicitly depends on $\frac{\partial 8}{\partial A}$ as seen in option(B) . if $\frac{\partial 8}{\partial A}$ change sign, so does $\frac{\partial Px}{d}$

2. **Correct Answer is (A and C):** A utility function v $(x_1, x_2, \dots, x_n)$ represents the same preference relation as u$(x_1, x_2, \dots, x_n)$ if and only if v is a **monotonic transformation** of u. Monotonic transformations include:

Adding a constant to u

Multiplying u by a positive constant

Applying any strictly increasing function to u

Option

$\boldsymbol{A}$: $-f(x_1, x_2, \dots x_n)$

$= U(x_1, x_2 \dots x_n) + \left(U(x_1, x_2 \dots x_n)\right)^3$

This is strictly increasing transformation of U, as :-

$f'(u) = 1 + 3u^2 > 0, \forall\, u > 0$

Since f is strictly increasing in U, it represents the same preference relation. **(Correct).**

Option B:- $g\ (x_1, x_2 \dots x_n) = U(x_1, x_2 \dots x_n) + \sum_{i=n}^{n} x_i$. Here, g adds $\sum_{i=1}^{n} x_i$ which depends on the values of x_i independently of $U(x_1, x_2 \dots x_n)$. This means g does not preserve the ranking implied by U, as the addition of $\sum_{i=1}^{n} x_i$ could change the ordering of preferences. **(Incorrect)**

Option (C): $h(x_1, x_2 \dots x_n) = \left(U(x_1, x_2 \dots x_n)\right)^{1/n}$

This is a strictly increasing transformation of U, as

$h'(u) = \frac{1}{n} u^{(1/n)-1} > 0\ \forall u > 0$

Since h is strictly increasing in U, it represents the sample preference relation. **(Correct)**

Option (D): $m(x_1, x_2 \cdots x_n) = U(x_1, x_2 \cdots x_n) + \sqrt{x_1^2 + x_2^2 + \cdots \cdot x_n^2}$ Here, m adds $\sqrt{x_1^2 + x_2^2 + \cdots + x_n^2}$, which depends on the value t of x_i independently of $U(x_1, x_2, \dots x_n)$. This addition can alter the ordering of preferences, so m does not preserve the preference relation. **(Incorrect)**

3. **Correct Answer is (B and C):**

Given three utility functions:-

$F = (4x_1, 2x_2), \quad G = \min(4x_1 + 2x_2), \quad H = \sqrt{x_1} + x_2$

Option A:- For $F = (4x_1, 2x_2)$

M.R.S $= \frac{M.Ux_1}{M.Ux_2} = \frac{4}{2} = 2,\ not - 1$

For $H = \sqrt{x_1} + x_2$

$M.Ux_1 = \frac{1}{2\sqrt{x_1}}, \quad M.Ux_2 = 1$

$\Rightarrow M.R.S = \frac{1}{2\sqrt{x_1}} = 0.5\sqrt{x_1}$

For $G = \min(4x_1 + 2x_2)$

$M.R.S = \frac{4}{2} = 2, not - 2$

Thus, **option A is incorrect**

Option (B): "If $p_{x_1} = p_{x_2}$, then the utility maximization problem with utility function F has a corner solution."

The utility function $F = (4x_1, 2x_2)$ is a **linear utility function**. Linear utility functions generally lead to corner solutions in utility maximization problems when the prices of the goods are equal and the consumer's income is finite.

When $p_{x_1} = p_{x_2}$, the consumer would allocate their budget entirely to the good that provides the highest utility per unit price. This would typically lead to a corner solution, i.e., consuming only one of the two goods.

Thus, **option B is correct.**

Option C:- For $G = min(4x_1 + 2x_2)$, the consumes maximizes utility by setting the two argument of the minimum function equal to each other, because G takes the minimum of the two values.

So, we set $4x_1 + 2x_2 = I$ where I = 100, $Px_1 = Px_2 = 2$.

Budget Constraint is :- $2x_1 + 2x_2 = 100$

Or $x_1 + x_2 = 50$

⇒ **option (C) is correct**

Option (D): "If income is 100, p_{x_1}=5, and p_{x_2} =5000, then in the utility maximization problem with the utility function H, the optimal value of x_2 is 20."

The utility function is $H = \sqrt{x_1} + x_2$ and budget constraint is: $5x_1 + 5000x_2 = 100$

We need to maximize H given this constraint. Since the price of x_2 is very high relative to x_1 , the consumer

will likely spend most of their income on x_1, and consume a very small amount of x_2 .

Solving the budget constraint for $x_2\ when\ x_1 = 0$.

$5000x_2 = 100$

$x_{2=}$ 100/5000= 0.02

This is much smaller than 20. Thus, **option D is incorrect.**

Conclusion for (D): **Option (D) is incorrect**.

Thus option B and C are correct

NAT (Numerical Answer Type)

1. Correct Answer is (-1): Let the initial price of food be P and the quantity demanded be Q. Initially, the total expenditure is:

Expenditure=P×Q

After the price increases by 20%, the new price becomes P'=1.2×P. The consumer adjusts their quantity demanded so that their expenditure remains the same, i.e., the total expenditure on food stays constant:

P×Q=P'×Q'

Substituting P'=1.2×P:

P×Q=(1.2×P)×Q'

This simplifies to:

Q=1.2×Q'

Thus, the new quantity demanded, Q', will be:

$Q' = \frac{Q}{12}$

The % change in quantity demanded = $\frac{Q'-Q}{Q} \times 100 = \frac{\frac{Q}{1.2}-Q}{Q} \times 100 = \frac{-0.2Q}{Q} \times 100 = \frac{-20}{100} = -20\%$

Price Elasticity of demand $(P_{ED}) = \frac{\%\ Change\ in\ Qunatatiy\ demanded}{\%\ Change\ in\ Price}$

$= \frac{-20\%}{20} = -1$

The Price. Elasticity of demand for food is – 1 meaning that the demand for food is Unit elastic.

2. Correct Answer is (10): To determine the consumer's new optimal consumption of x_2 when income increases by 50%, we use the following steps:

Given:

Utility function: $u(x_1, x_2) = x_1 + 2\sqrt{x_2}$,

Initial optimal consumption: $x_1 = 10, x_2 = 10$,

Prices of goods are unchanged,

Income increases by 50%.

Budget Constraint: Let the initial income be I, and the prices of x_1 and x_2 be p_1 and p_2, respectively. At the initial optimal bundle:

$I = p_1x_1 + p_2x_2$.

Substitute $x_1 = 10, x_2 = 10$:

$I = 10p_1 + 10p_2$.

When income increases by 50%, the new income becomes:

$I' = 1.5I = 1.5(10p_1 + 10p_2) = 15p_1 + 15p_2$.

Consumer's Optimization Problem: The consumer maximizes utility $u(x_1, x_2) = x_1 + 2\sqrt{x_2}$ subject to the budget constraint:

$p_1x_1 + p_2x_2 = I'$.

The Lagrangian for this problem is:

$\mathcal{L} = x_1 + 2\sqrt{x_2} + \lambda(I' - p_1x_1 - p_2x_2)$.

First-Order Conditions: Take partial derivatives with respect to x_1, x_2, and λ:

1. $\frac{\partial \mathcal{L}}{\partial x_1} = 1 - \lambda p_1 = 0$, so $\lambda = \frac{1}{p_1}$,
2. $\frac{\partial \mathcal{L}}{\partial x_2} = \frac{1}{\sqrt{x_2}} - \lambda p_2 = 0$, so $\frac{1}{\sqrt{x_2}} = \lambda p_2$,
3. $\frac{\partial \mathcal{L}}{\partial \lambda} = I' - p_1x_1 - p_2x_2 = 0$.

From the first two conditions, substitute $\lambda = \frac{1}{p_1}$ into $\frac{1}{\sqrt{x_2}} = \lambda p_2$:

$\frac{1}{\sqrt{x_2}} = \frac{p_2}{p_1}$.

Simplify to find x_2:

$\sqrt{x_2} = \frac{p_1}{p_2}, x_2 = \left(\frac{p_1}{p_2}\right)^2$.

Optimal Consumption of x_2 at New Income

Notice that the optimal choice of x_2 depends only on the ratio of prices $\frac{p_1}{p_2}$, not income. Since the prices remain unchanged, the optimal x_2 does not change even with the income increase. Therefore:

$x_2 = 10$.

Final Answer: The consumer's optimal choice of x_2 remains **10** even after the income increases by 50%.

3. Correct Answer is (2):

Given: -Amar's Utility functions:-

$U_A(f_A, w_A) = f_AW_A$

Barun's utility functions:-

$U_B(f_B, W_B) = \min(f_B, w_B)$

Barun's utility depends on the minimum of his food and water consumption. This suggests that Barun's utility will be maximized when the amounts of food and water he consumes are equal.

Step 2: Budget Constraints

Each person has an initial endowment of food and water. Amar's initial endowment is $F_A = 2$ and W_A=5, and Barun's initial endowment is F_B=8 and W_B=5.

Let the prices of food and water be p_f andp_w, respectively. The total expenditure of each person on food and water will be:

Given: -Amar's Utility functions:-
$U_A(f_A, w_A) = f_A W_A$
Barun's utility functions:-
$U_B(f_B, W_B) = \min(f_B, w_B)$
Then theory Portion
Aman's budget Constraint:-
$P_F\, F_A + P_w w_A = p_f \times 2 + p_w \times 5$
Barun's budget Constraint:-
$P_F\, F_A + P_w W_A = p_f \times 2 + p_w \times 5$
Since, Amar and Brrun trade food and waters, they both try to maximize their utilities by choosing this consumption quantities.
Amar maximizes $U_A(f_A, w_A) = f_A^2\, w_A$ subject to his budget constraint. The marginal utilites of food and water are :-
$MU_{FA} = 2f_A W_A, \quad MU_{wA} = f^2 A$
Now $\frac{MU_{FA}}{MU_{wA}} = \frac{2f_A w_A}{f^2 A} = 2w_A$
In competitive equilibrium this ration should be equal to the price ration $\frac{p_f}{p_w}$, So:-
$\frac{2w_A}{f_A} = \frac{p_f}{p_w}$
Now Barun Maximize $U_B(f_B, w_B) = \min(f_B, w_B)$. To Maximize utility Barun will consume an equal amount of food and water i.e. $f_B = w_B$
Barun's budget constraint is :-
$P_F P_B + P_w\, W_B = P_f \times 8 + P_U \times 5$
Put $f_B = w_B$
$\Rightarrow P_f\, f_B + P_w\, f_B = P_f \times 8 + P_w \times 5$
$\Rightarrow f_B(P_f + P_w) = P_f \times 8 + P_w \times 5$
$f_B = \frac{p_f \times 8 + p_w \times 5}{(P_f + p_w)}$
Since $f_B = w_B$, this also gives Barun's Consumption of water
Now, the total amount of food :-
$f_A + f_B = F_A + F_B = 2 + 8 = 10$
Total amount of water is :-
$w_A + w_B = w_A + w_B = 5 + 5 = 10$
From this, we have
$f_A + f_B = 10, \quad w_A + w_B = 10$
By solving these conditions for f_A, w_a and $f_b = w_B$, we can determine that in the competitive equilibrium, the price ratio $\frac{p_f}{p_w}$ will *be* 2.

4. Correct Answer is (8): Given production function $y = K^{0.5}L^{0.5}$ where. wage rate $(\omega) = 4$, Rental rate of Capital $(r) = 4$.
Marginal Rate of Technical Substitution (M.R.T.S) $= \frac{M \cdot P_L}{M \cdot P_K} = \frac{\omega}{\mathrm{r}}$

$M \cdot P_L = \frac{\partial y}{\partial L} = 0.5K^{0.5} \cdot L^{-0.5}$
$M \cdot P_K = \frac{\partial y}{\partial K} = 0.5K^{-0.5} \cdot L^{0.5}$
$M \cdot R \cdot T \cdot S = \frac{0.5K^{0.5}L^{-0.5}}{0.5K^{-0.5} \cdot L^{0.5}} = \frac{L}{K}$
Input-price ratio is $\frac{\omega}{r} = \frac{4}{4} = 1.$
Thus $\frac{L}{K} = 1 \Rightarrow L = K.$
Pat $L = K$ into the production function:-
$y = K^{0.5}L^{0.5} = K^{0.5}K^{0.5} = K\cdot$
$y = K^{0.5}L^{0.5} = K^{0.5}K^{0.5} = k$
Thus $K = y$ and $L = y$
Total Cost (T.C) $= \omega L + rK.$
Put $L = y, K = y$
$\Rightarrow T \cdot C = 4L + 4K = 4y + 4y = 8y$
$M \cdot C = \frac{d}{dy}(T \cdot C) = \frac{d}{dy}(8y) = 8$

5. Correct Answer is (2): To determine the lowest price $(\bar{p_1})$ such that the consumer only buys good 2 when $p_1 > \bar{p_1}$, we analyze the utility function: $u(x_1, x_2) = \max\{0.5x_1, 0.5x_2\} + \min\{x_1, x_2\}$.
Given $p_2 = 1$, the budget constraint is: $p_1 x_1 + x_2 \leq y$.
The utility function combines max and min, so the consumer's preferences depend on both the relative sizes and amounts of x_1 and x_2.
For $u(x_1, x_2)$ to be maximized:
If $0.5x_1 > 0.5x_2$, then the max term is $0.5x_1$.
If $x_1 > x_2$, the min term is x_2.
The consumer will buy only x_2 when the marginal utility per dollar spent on x_1 is less than that for x_2. This occurs when the price of x_1 becomes sufficiently high. To compute this threshold:

1. The marginal utility from spending on x_1 is determined by $0.5 + 1$ (because utility from x_1 includes contributions from both the max and min terms).
   The marginal utility per dollar for x_1 is:
2. $\mathrm{MU}_1/p_1 = (0.5 + 1)/p_1 = 1.5/p_1$.
3. The marginal utility from spending on x_2 is determined by $0.5 + 1$, giving:
   $\mathrm{MU}_2/p_2 = (0.5 + 1)/1 = 1.5$.
4. The consumer will only buy x_2 when: $\frac{1.5}{p_1} < 1.5$.
5. Simplify: $p_1 > 1$.

Determining $(\bar{p_1})$
The lowest price of p_1 such that the consumer buys only x_2 is: $\bar{p_1} = 2$.
Hence, the answer is 2.

6. Correct Answer is (1.02): The consumer's utility is:-

$W_t = \ln(C_t) + \frac{1}{1+\theta}\ln(C_{t+1})$, where θ is the time discount rate.

Budget Constraint is: $C_t + \frac{C_{t+1}}{1+r} \le y_t + \frac{y_{t+1}}{1+r}$

Lagrangian for this optimization problem is:-

$$\mathcal{L} = \ln(C_t) + \frac{1}{1+\theta}\ln(C_{t+1}) + \lambda\left(y_t + \frac{y_{t+1}}{1+r} - C_t - \frac{C_{t+1}}{1+r}\right)$$

Where λ = Lagrange multiplier.

First Order condition for utility maximization is:-

$\frac{\partial \mathcal{L}}{\partial C_t} = \frac{1}{C_t} - \lambda = 0$

$\Rightarrow \lambda = \frac{1}{C_t}$

Now $\frac{\partial \mathcal{L}}{\partial C_{t+1}} = \frac{1}{(1+\theta)C_{t+1}} - \lambda\frac{1}{1+r} = 0$

Put $\lambda = 1$

Put $\lambda = \frac{1}{c_t}$

$\Rightarrow \frac{1}{(1+\theta)c_{t+1}} - \frac{1}{c_t}\cdot\left(\frac{1}{1+r}\right) = 0$

or $\frac{1}{(1+\theta)C_{t+1}} = \frac{1}{c_t}\left(\frac{1}{1+r}\right)$

or $\frac{1}{C_{t+1}} = \frac{(1+\theta)1}{c_t}\cdot\left(\frac{1}{1+r}\right)$

or $\frac{Ct}{Ct+1} = \frac{1+\theta}{1+r}$

or $\frac{C_{t+1}}{C_t} = \frac{1+r}{1+\theta}$

Given $\theta = 0.05, r = 0.08$

$\Rightarrow \frac{C_{t+1}}{C_t} = \frac{1+0.08}{1+0.05} = \frac{1.08}{1.05} = 1.02$

7. Correct Answer is (0.307): Given $P = e^{\frac{-x}{2}}$ where x = quantity, P = price

Also = $P = 0.5$

Now Consumer Surprise = $\int_0^{x_0} P(x)dx - P.x_0$

Now $e^{\frac{-x_0}{2}} = 0.5$

Take Natural log on both sides :-

$\Rightarrow \frac{-x_0}{2} = ln(0.5)$

$\Rightarrow x_0 = -2\,ln(0.5)$

Using $\ell n(0.5) = -\ell n(2)$

$\Rightarrow x_0 = 2\ell n(2)$

Now, Consumer Surplus = $\int_0^{x_0} e^{-x/2}\,dx - 0.5\,.x_0$

Now $\int_0^{x_0} e^{-x/2}\,dx$:

Put $-\frac{x}{2} = t$

$\Rightarrow -x = 2t$

$\Rightarrow -dx = 2\,dt$

$\Rightarrow \int_0^{x_0} e^t\,.(-2\,dt)$

$\Rightarrow [-2\,e^t]_0^x = -2\left[e^{-\frac{x}{2}}\right]_0^{x_0} = -2\left[e^{-\frac{x_0}{2}} - e^0\right]$

$= -2\left[e^{-x_0/2} - 1\right]$

$\Rightarrow -2[0.5 - 1] = -2(-0.5) = 1$

Also $0.5\,x_0 = 0.5\left(-2\ell n(0.5)\right) = \ell n(2)$

Now Consumer surplus $= 1 - \ell n(2) = 1 - 0.69 = 0.307$

8. Correct Answer is (64): Given Utility function is :-

$U(x_1, x_2) = (2x_i - 1)^{0.25}(x_2 - 4)^{0.75}$

Budget Constraint is : $2x_1 + x_2 = 73$ where

$Px_1 = 2, Px_2 = 1, Income\ (I) = 73.$

The Consumer maximizes utility subject to the budget Constraint. To do we will set up the Lagrangian

$\mathcal{L} = (2x_1 - 1)^{0.25}(x_2 - 4)^{6-75} + \lambda(73 - 2x_i - x_2)$

Differentiate w.r.t. $x_1, x_2\ and\ \lambda$

$\frac{\partial \mathcal{L}}{\partial x_1} = 0.25(2x_1 - 1)^{-0.75}(2)(x_2 - 4)^{0.75} - 2\lambda = 0$

$\frac{\partial \mathcal{L}}{\partial x_2} = 0.75(2x_1 - 1)^{0.25}(x_2 - 4)^{-0.25} - \lambda = 0$

$\frac{\partial \mathcal{L}}{\partial \lambda} = 73 - 2x_1 - x_2 = 0$

Now, Marginal rate of Substitution $(M.R.S)$ is :-

$\frac{\partial \mathcal{L}/\partial x_1}{\partial \mathcal{L}/\partial x_2} = \frac{0.25(2)(2x_1 - 1)^{-0.75}(x_2 - 4)^{0.75}}{0.75(2x_1 - 1)^{0.25}(x_2 - 4)^{-0.25}} = \frac{2\lambda}{\lambda}$

$= \frac{0.5(x_2 - 4)^{0.75+0.25}}{0.75(2x_2 - 1)^{0.75+0.25}} = 2$

$i.e\ 0.5(x_2 - 4) = 1.5(2x_1 - 1)$

$0.5x_2 - 2 = 3x_1 - 1.5$

$0.5x_2 = 3x_1 - 1.5 + 2$

$0.5x_2 = 3x_1 + 0.5$

$x_2 = \frac{3x_1}{0.5} + \frac{0.5}{0.5} = 6x_1 + 1$

Now $2x_1 + x_2 = 73$

$2x_1 + 6x_1 + 1 = 73$

$8x_1 = 72$

$x_1 = 9$

Now $x_2 = 6(9) + 1 = 55$

Now $x_1 + x_2 = 9 + 55 = 64$

$\Rightarrow x_1 + x_2 = 64$

9. Correct Answer is (50): To find the utility-maximizing quantity of x, we need to apply the **Lagrangian method** for utility maximization.

The utility function is:

$$u(x, y) = x \cdot y$$

Given:

- Price of x (denoted as P_x) = Rs. 1
- Price of y (denoted as P_y) = Rs. 2
- Income of the consumer (denoted as I) = Rs. 100

The consumer's budget constraint is:

$$P_x \cdot x + P_y \cdot y = I$$

Substituting the given values:

$$1 \cdot x + 2 \cdot y = 100$$

Simplifying the budget constraint:

$$x + 2y = 100$$

The Lagrangian function is:

$$\mathcal{L}(x, y, \lambda) = x \cdot y + \lambda(100 - x - 2y)$$

Where λ is the Lagrange multiplier.

First, we need to take the partial derivatives with respect to x, y, and λ, and set them equal to zero:

1. $\frac{\partial \mathcal{L}}{\partial x} = y - \lambda = 0$
2. $\frac{\partial \mathcal{L}}{\partial y} = x - 2\lambda = 0$
3. $\frac{\partial \mathcal{L}}{\partial \lambda} = 100 - x - 2y = 0$

Solving these equations:

From equation (1):

$$y = \lambda$$

From equation (2):

$$x = 2\lambda$$

Substitute $y = \lambda$ and $x = 2\lambda$ into the budget constraint equation:

$$2\lambda + 2\lambda = 100$$
$$4\lambda = 100$$
$$\lambda = 25$$

Now substitute $\lambda = 25$ into the equations for x and y:

$$x = 2\lambda = 2 \times 25 = 50$$
$$y = \lambda = 25$$

Thus, the **utility-maximizing quantity of** x is **50**.

10. Correct Answer is (3):

The utility function is:

$$u(x_1, x_2) = \min\{x_1, x_2\}$$

This represents perfect complements, so the consumer optimally consumes the goods in equal quantities:

$$x_1 = x_2 = x$$

Given prices:

$$p_1 = 1,\ p_2 = 2$$

Total expenditure is:

$$M = p_1 x_1 + p_2 x_2$$
$$M = x + 2x = 3x$$

Since $x_2 = x$,

$$M = 3x_2$$

The Engel curve has income M on the vertical axis and quantity x_2 on the horizontal axis. Therefore, its slope is:

$$\frac{dM}{dx_2} = 3$$

11. Correct Answer is (41.4):

The utility function is:

$$u(x_1, x_2) = x_1 x_2$$

Initial prices and income:

$$p_1 = 1,\ p_2 = 1,\ M = 100$$

For Cobb-Douglas utility $u = x_1 x_2$, the consumer spends **half of income on each good**.

Thus initially:

$$x_1 = x_2 = 50$$

Initial utility:

$$U_0 = x_1 x_2 = 50 \times 50 = 2500$$

Now, price of X_2 doubles:

$$p_1 = 1,\ p_2 = 2$$

Find expenditure required to maintain $U_0 = 2500$:

Utility maximization gives:

$$\frac{MU_1}{p_1} = \frac{MU_2}{p_2}$$

Since

$$MU_1 = x_2,\ MU_2 = x_1$$
$$\frac{x_2}{1} = \frac{x_1}{2}$$
$$x_1 = 2x_2$$

Maintaining the original utility:

$$x_1 x_2 = 2500$$
$$2x_2^2 = 2500$$
$$x_2 = \sqrt{1250}$$

and

$$x_1 = 2\sqrt{1250} = \sqrt{4 \times 1250} = \sqrt{5000}$$

Required expenditure:

$$E = p_1 x_1 + p_2 x_2 = x_1 + 2x_2 = \sqrt{5000} + 2\sqrt{1250}$$
$$\approx 141.4$$

Compensating Variation is the additional income required after the price change to attain the original utility:

$$\therefore CV = 141.4 - 100 = 41.4$$

Unit 1.2: Theory of production and cost

MCQ (Multiple Choice Questions)

[2021: 2 Mark]

1. There are only two firms in an industry producing a homogenous product and having identical production technology. The cost function of firm i is $C_i(q_i) = qi^2, for\ i = 1,2;$ where q_i is the quantity produced by firm i. The market demand for the product is $p = 100 - q$, where p is the unit price and $q = q_1 + q_2$ is the aggregate quantity. Assuming the firms are price takers, the competitive equilibrium solution of p and q in this market is

(A) $p = 80, q = 20$
(B) $p = 20, q = 80$
(C) $p = \frac{200}{3}, q = \frac{100}{3}$
(D) $p = 50, q = 50$

[2022: 1 Mark]

2. A long-run cost function for a product exhibits economies of scale if

(A) average cost of production increases when the output increases.
(B) the production function has returns to scale.
(C) average cost of production falls as the output increases.
(D) average cost of production remains constant as the output increases.

[2022: 2 Mark]

3. Let a production function be given by

$$\log Q = \frac{\beta}{a} \log (L^a + K^a), \text{where } a \in (-\infty, 1] - \{0\} \text{ and } \beta > 0.$$

Then identify the statement that is NOT correct.

(A) The ratio β/a helps in identification of returns to scale factor
(B) For $\beta > 1$, the function exhibits increasing returns to scale, and for $\beta < 1, it\ shows$ decreasing returns to scale.
(C) The elasticity of substitution is $\frac{1}{1-\alpha}$
(D) The elasticity of substitution is $\frac{1}{1-\beta}$

[2022: 2 Mark]

4. The short-run production function of a firm is $Q = 200 + 0.2L^2 - 0.0004L^3$. If wage rate equals Rs. 140 and the number of labours (L) is 100, then the Marginal Cost and Average Variable Cost, respectively, are

(A) 5 and 7.78 (B) 6 and 7.78
(C) 5 and 6.68 (D) 6 and 6.68

[2024: 1 Mark]

5. Consider a production function of the form:

$Y = a \log L + (1-a) \log K,\ \ a \in (0,1),\ \ a \neq 0.5$

where, Y is output, L is labour, and K is capital. Then, the absolute value of elasticity of substitution is

(A) 1 (B) a
(C) $(1-a)$ (D) ∞

[2024: 2 Mark]

6. Let the production function be given by

$Y_t = A_t K_t^{\alpha} H_t^{\beta} L_t^{1-\alpha-\beta}$ **where, at time t, Y_t is output, A_t is level of Total Factor Productivity, K_t is physical capital, H_t is human capital, and L_t is labour. $\alpha = \frac{1}{5}$ and $\beta = \frac{2}{5}$. If the growth rate of Y_t equals 10 percent, the growth rate of K_t equals 5 percent, the growth rate of H_t equals 5 percent, and the growth rate of L_t equals 10 percent, then the growth rate of A_t is**

(A) 2 percent (B) 3 percent
(C) 5 percent (D) 10 percent

[2024: 2 Mark]

7. Consider an economy where technology is characterised by the product function:

$$Y = 50K^{0.4}L^{0.6}$$

where, Y is output, K is capital, and L is labour. Assuming perfect competition in the product market and in the factor market the share of total income paid to labour is equal to

(A) 0.2 (B) 0.3
(C) 0.4 (D) 0.6

[2024: 2 Mark]

8. Consider the production function:

$Q(K,L) = \left(2\sqrt{K} + 3\sqrt{L}\right)^2$ **where Q is the output, K is capital, and L is labour. If η_K and η_L, denote the output elasticities with respect to capital and labour, respectively, then the value of $(\eta_K + \eta_L)$ is**

(A) 2 (B) 1
(C) 4 (D) 0.5

[2025: 2 Mark]

9. If $Y = L^{\alpha}K^{\beta}$ is a Cobb-Douglas production function with two factors labor and capital, then the presence of constant returns to scale exhibited by the production function can be tested using _____.

(A) only t statistic
(B) only F statistic
(C) both t and F statistic
(D) χ^2 statistic