Learn DU

SOLVED PYQ

Paper: Intermediate Microeconomics-I

Course: B. A.(Hons.) Economics SEM-III

Year: 2023-24

Unique Paper Code : 2272102301

Paper : **ECON007: Intermediate Microeconomics–I**

(Behavioural Foundations of market Interactions)

Course : B.A. (Hons.) Economics II Year

Duration : 3 Hours

Maximum Marks : 90

Semester–3

Dec./Jan.

2023–24

The questions paper is divided into two sections: Section A and Section B. Answer any three questions from Section A and any two questions from Section B.

SECTION A

Q. 1. (a) Let utility function of a consumer be given by $U(x, y) = xy + x$, where X and Y are the two goods

(i) Is marginal rate of substitution diminishing?

(ii) Are marginal utilities of both goods X and Y diminishing?

(b) Let Mr. Ramesh have an income of ₹ 1000, which he can spend on two goods X and Y. Let price of good X be ₹ 80 for the first two units and then it is ₹ 60 for the subsequent units. Let price of good Y be ₹ 50 regardless of how many units bought. Write the equation of the budget line and draw it.

(c) Find the equation of the price offer curve and demand curve for the following utility function : $U = \min(3x, 2y)$. Let income of the consumer be M, price of good X is P^x and price of good Y be P_y. Also draw both the curves.

(d) Draw indifference maps for the following utility functions. Also indicate the preference direction

(i) $U(x, y) = x$

(ii) $U(x, y) = -x - y$ 5×4

Ans. (a) $$u(x, y) = xy + x$$

(i) $$\text{MRS} = \frac{y+1}{x};$$

as y decreases and x increases, MRS diminishes.

(ii)
$$MU_x = y + 1$$
$$MU_y = x$$
$$\frac{dMU_x}{dx} = 0$$
$$\frac{dMU_y}{dy} = 0$$

(b) $$y = \frac{1000}{50} - \frac{80\,x}{50}, \text{ for all } x \le 2$$

$\Rightarrow$ $$y = \frac{1000}{50} - \left[\left(\frac{80-60}{50}\right)2\right] - \frac{60}{50}x; \text{ for } x > 2$$

$$= 20 - \left[\left(\frac{20}{50}\right)2\right] - \frac{6}{5}x$$

$$= 20 - \left(\frac{40}{50}\right) - \frac{6}{5}x$$

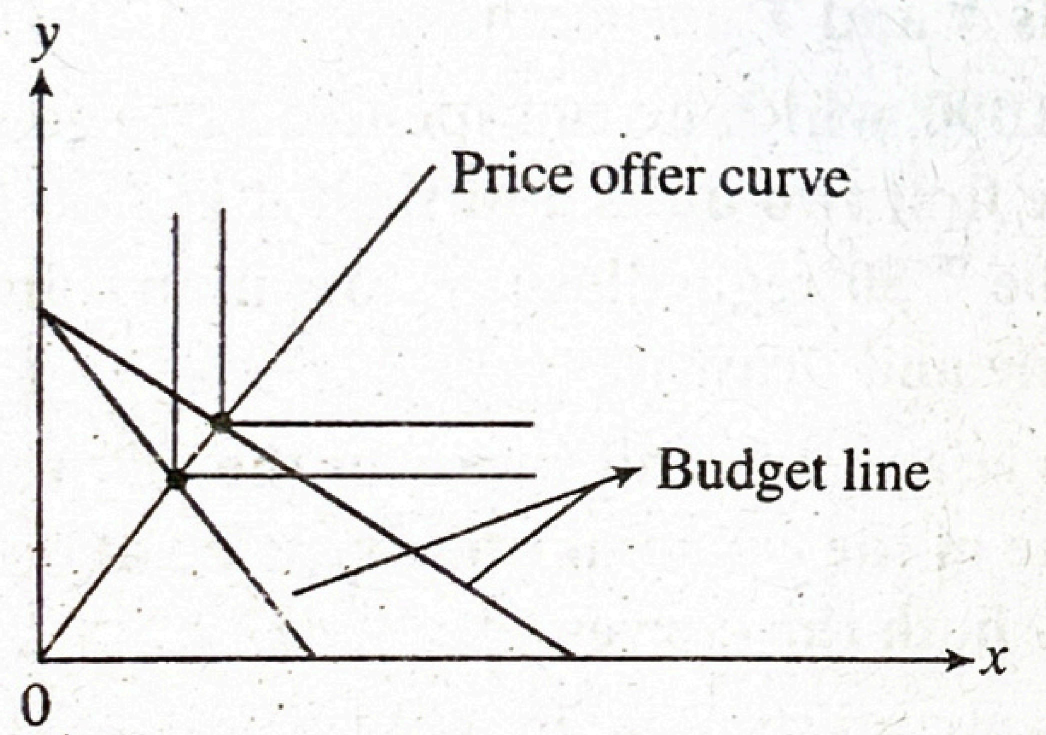
$$= 9\frac{1}{5} - \frac{6}{5}x, \text{ for } x > 2$$

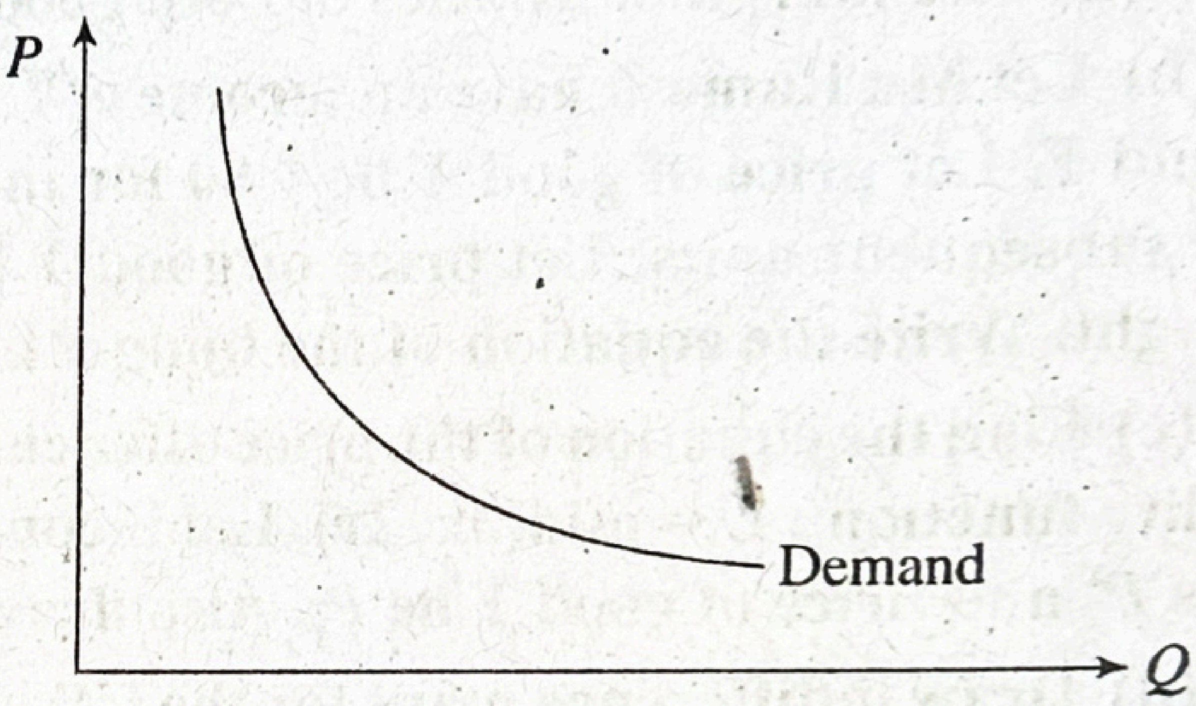
(c) $u = \min(3x, 2y)$

Good are perfect complements, IC 'L' shaped.

Kink is at $3x = 2y$

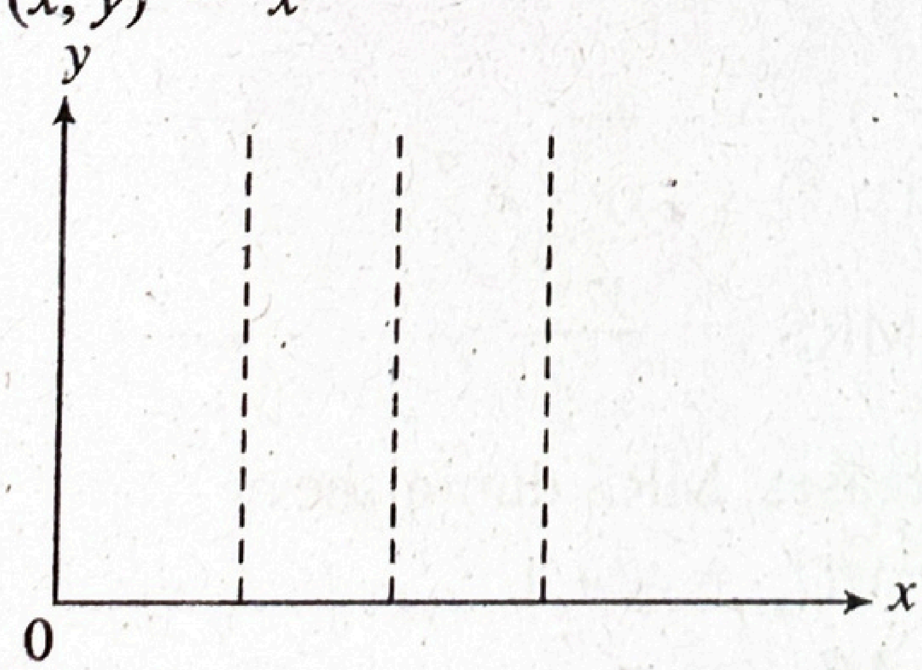
$\Rightarrow$ $x = \frac{2}{3}y$





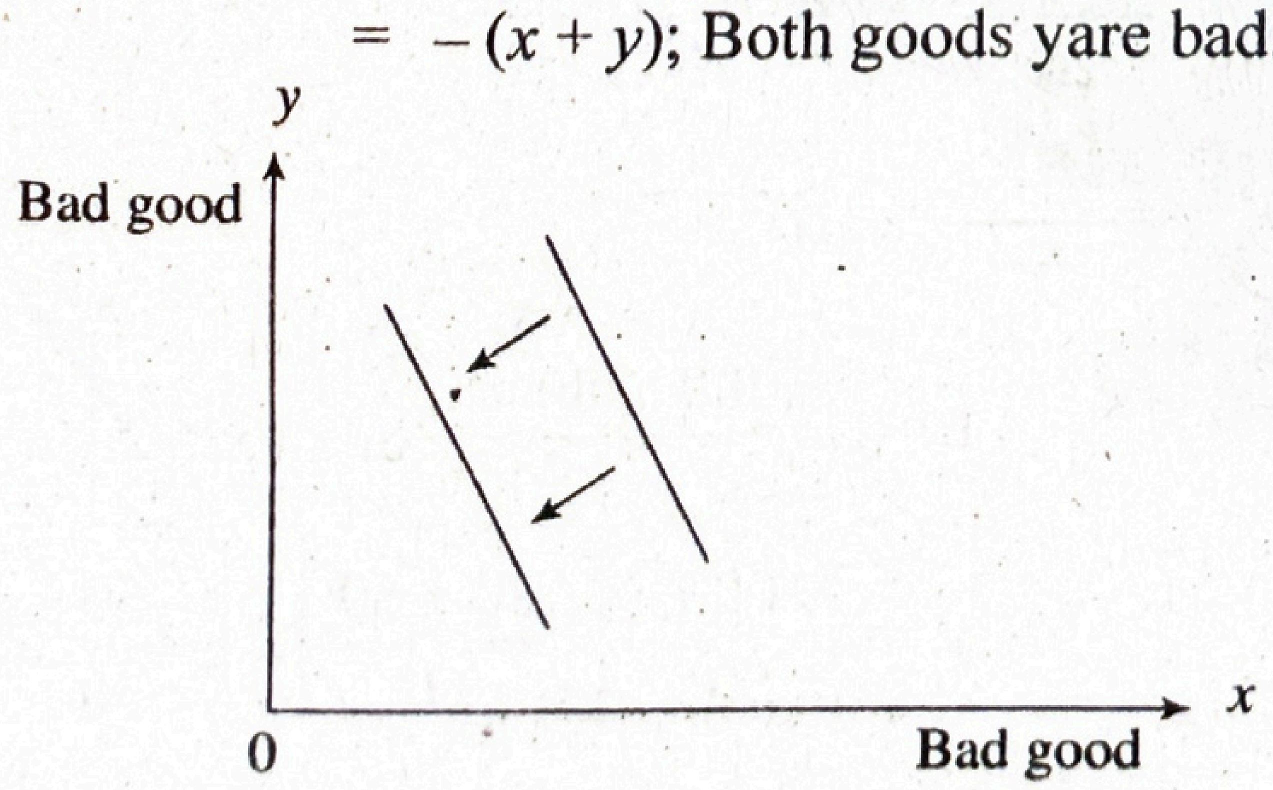
(d) (i) Indifference Map

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



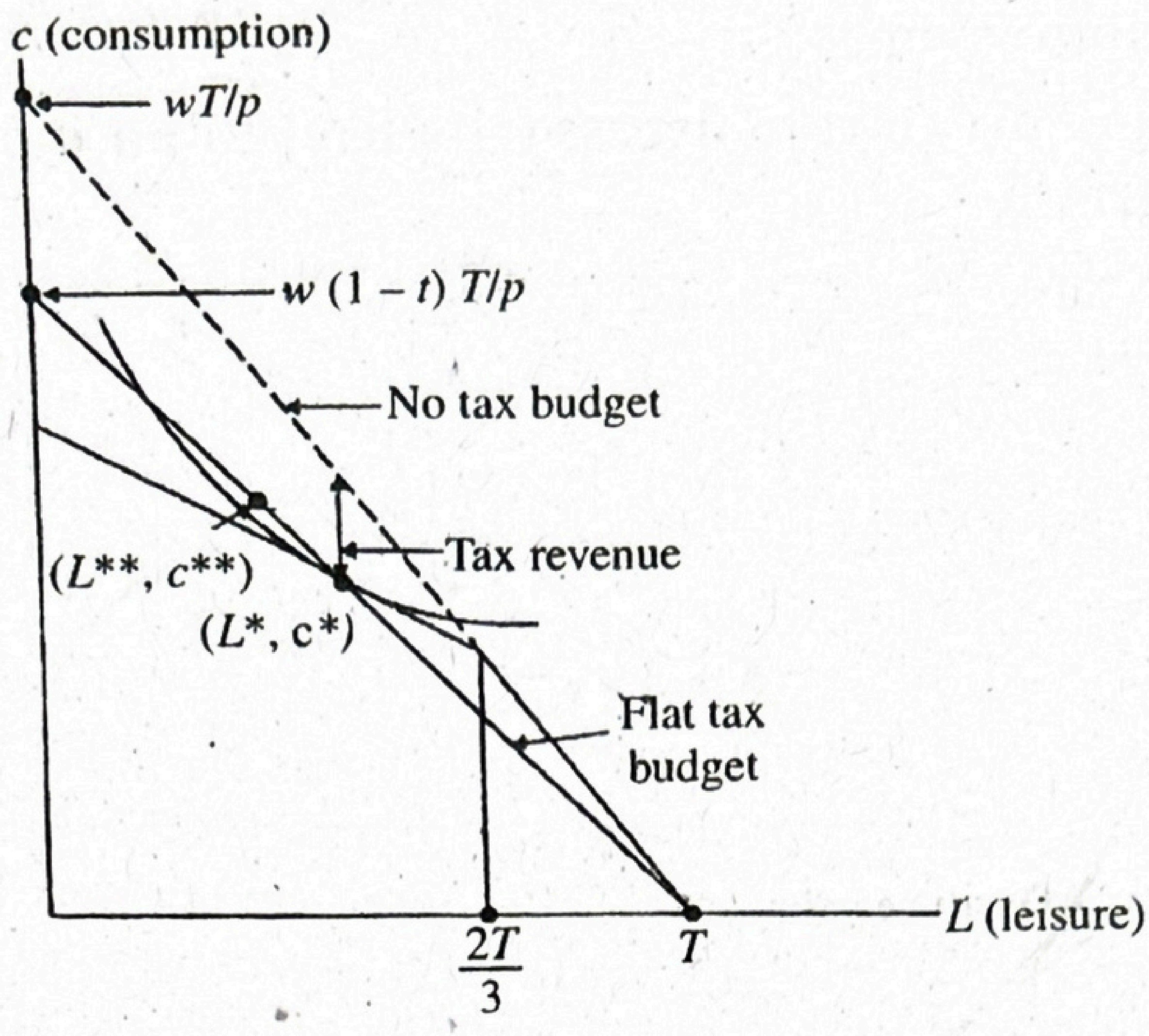
(ii) $U(x, y) = -x - y$

$= -(x + y)$; Both goods yare bad.



Q. 2. (a) Using a diagram illustrate how a flat tax on income would make the consumer better off as well as bring more revenue for the government compared to a two-bracket progressive income tax. 6

Ans.



A budget constraint with a progressive tax (two brackets), showing that a flat tax would be better for this consumer, better for the government, and would result in more hours of work by this consumer

(b) Let Miss Mary earn an income of ₹ 2000 this month and ₹ 2200 next month. Her utility function is $U(C_1, C_2) = C_1 C_2$, where C_1 denotes the value of consumption this month and C_2 denotes the value of consumption next month. Let interest rate be 5%. Would Miss Mary borrow, lend or do neither? What happens if interest rate rises to 12%? In which case is the utility higher? 10

Ans. At interest rate 5% (i = 5%)

$$|MRS| = \frac{C_2}{C_1} = 1.05$$

$$\text{Budget line is } C_1 + \frac{C_2}{(1+i)} = 2000 + \frac{2200}{(1+i)}$$

$$2C_1 = 4095$$
$$C_1 = 2047.5$$
$$C_2 = 2150$$
$$U = 4401050$$

Now, if interest rate is 12% (i = 12%)

$$|MRS| = \frac{C_2}{C_1} = 1.12$$

$$\text{Budget line is } C_1 + \frac{C_2}{1.12} = 2000 + \frac{2200}{(1.12)}$$

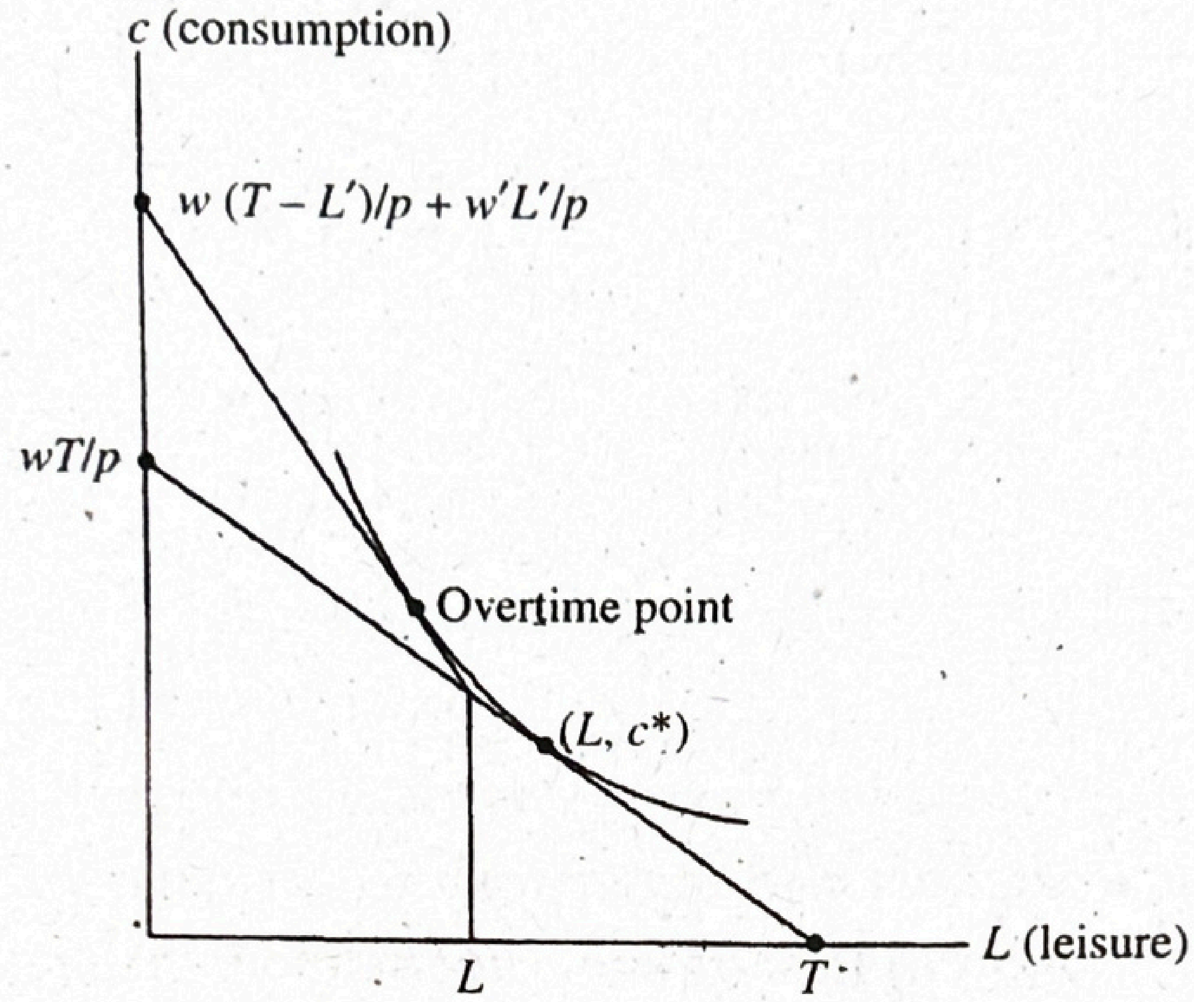
$$2C_1 = 3964.2$$

$$C_1 = 1982.1$$
$$C_2 = 2224$$
$$U = 4400350.8$$

$\therefore$ Utility is higher in case of borrowing.

(c) Will an increase in overtime wage rate necessarily lead to an increase in labor supply? Show using a diagram. **4**

Ans. Increase in overtime wage rate.



A budget constraint with overtime pay for work hours beyond T – L' Given this overtime rate w' this consumer is indifferent between working overtime (and getting to the "Overtime point"), and working no overtime (and getting to the point (L,c*)).*

Q. 3. (a) Suppose a consumer consume two goods X and Y. The utility function is: $U(x, y) = 2\sqrt{x} + y$. Let price of x be ₹ 0.50, price of Y be ₹ 1 and income is ₹ 10.

(i) Find initial equilibrium of the consumer.

(ii) Find the new equilibrium if price of X falls to ₹ 0.20.

(iii) Using Hicksian technique decompose the price effect into substitution and income effects.

(iv) Calculate the compensating variation in the above case. **8**

Ans. $$U = 2\sqrt{x} + y$$

(i) Initial equilibrium — Initial $u = (2)(2) + 8 = 12$

$$MRS = \frac{1/\sqrt{x}}{1} = \frac{1}{2}$$

$$\Rightarrow \quad \frac{1}{\sqrt{x}} = \frac{1}{2}$$

$$\Rightarrow \quad \sqrt{x} = 2$$

$$\therefore \quad x = 4$$

Also from budget line

$$4\,(0.5) + 1\,(y) = 10$$

$\therefore$ $$y = 8$$

(ii) $$\frac{1/\sqrt{x}}{1} = \frac{0.20}{1}$$

$\Rightarrow$ $$1/\sqrt{x} = 1/5$$

$\Rightarrow$ $$\sqrt{x} = 5$$

$\therefore$ $$x = 25$$

and, $$y = 5$$

Final Utility

$$u = 2\sqrt{25} + 5$$
$$= 2\,(5) + 5$$
$$= 10 + 5$$
$$= 15$$

(iii) At initial equilibrium, $u = 2\sqrt{4} + 8 = 12$

Also along the compesated BL, slope = $\frac{0.2}{1}$

So, $$\frac{1}{\sqrt{x}} = 0.2 \qquad \therefore\ x = 25$$

By y is given by $u = 12 = 2\sqrt{x} + y$

$$12 = (2)\,(5) + y \qquad \Rightarrow y = 2$$

$\therefore$ Income effect is zero for good x.

$$SE = PE = 21 \text{ units for good } x.$$

(iv) Initial utility $u = 12$

At new prices $P_x = 0.2$ and $P_y = 1$

We need $(0.2)\,(25) + (1)\,(2) = 7$ units of M

$$CV = 10 - 7 = 3$$

($CV = I - I_B$) where I is consumer's income and I_B is income needed to purchase compenated bundle.

CV is the difference between the income she would need to buy basket at initial prices and income of ₹ 10, utility should be 15 along it.

$$u = 2\sqrt{x} + y = 15$$

$$MRS = \frac{1}{\sqrt{x}} = \frac{0.5}{1} \qquad \therefore \quad x = 4$$

If $x = 4$, we need $y = 11$

Such that $$2\sqrt{x} + y = y$$

$$x = 4$$
$$y = 11$$

We need income of $(0.5)\,(4) + (1)\,(11) = 15$

$$CV = 13 - 10 = 3$$

(b) Let two utility functions be given as

$$U(x, y) = xy$$
$$U(x, y) = e^{xy} + 5$$

Do they represent same preferences? 6

Ans. (i) $U(x, y) = xy$

(ii) $U(x, y) = e^{xy} + 5$

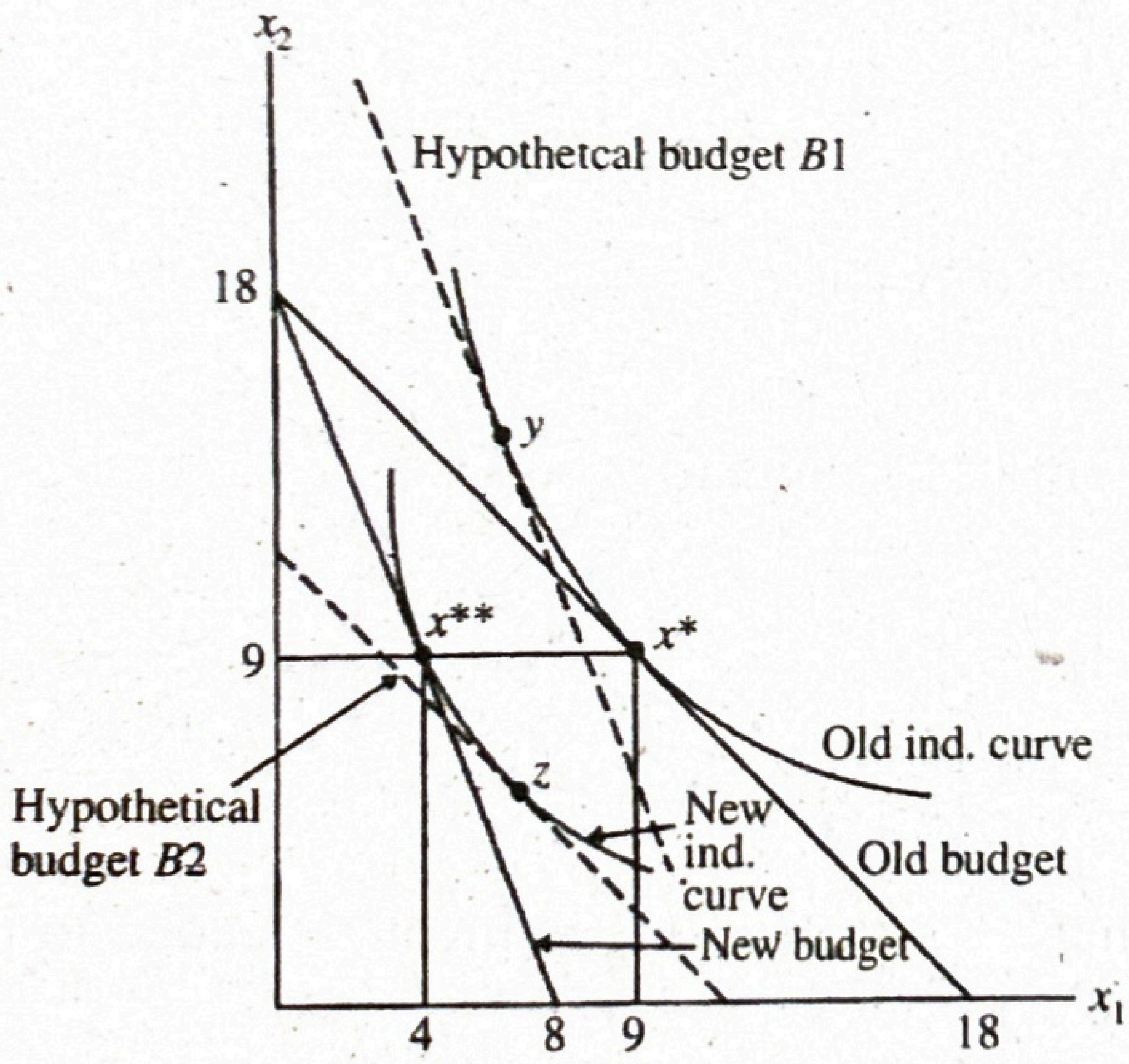
Yes, $|MRS|$ is same

(i) $$MRS = \left|\frac{MU_x}{MU_y}\right| = \frac{y}{x}$$

(ii) $$|MRS| = \frac{y \cdot e^{xy}}{x \cdot e^{xy}} = \frac{y}{x}$$

(c) Using a diagram, show the Kaldor}s variant of decomposition of price effect if price of x falls and x is a normal good. 6

Ans.



*There are two ways to measure the consumer's loss in dollars. Compensating variation is the dollar value of the y to j** income effect (based on the new prices); equivalent variation is the dollar value of the x* to z income effect (based on the old prices). Positions of y and z are approximate.*

Q. 4. Let utility function be $U(x) = x^2$, where x denotes income level. The consumer faces the following scnario: he can earn ₹ 100 with a probability of 0.4 and ₹ 600 with a probability of 0.2

(i) Using only the utility function show that the preferences show he is a risk lover.

(ii) Calculate expected utility and utility equivalent of the income. Do they confirm he is a risk lover?

(iii) Calculate Certainty equivalent of his income.

(iv) Give the wquation showing the risk premium of the consumer.

(v) Represent Risk Premium and Certainty Equivalent for a risk loving consumer in a diagram.

(vi) Calculate Arrow-Pratt Coefficient of Absolute Risk Aversion and interpret it. 3.5×5+2.5

Ans. (i) $U = x^2$

Risk loving; $\frac{dU}{dx} = 2x$

$$\frac{d^2U}{dx^2} = 2$$

Since it is positive, he is a risk lover.

(ii) $E(U) = (0.4)(100)^2 + (0.4)(100)^2 + (0.2)(600)^2 = 80{,}000$

$$EV = (0.4)(100) + (0.4)(100) + (0.2)(600) = 200$$

Since $U(EV) < E(U)$; so, the person is a risk lover

(iii) $CE = EV - RP$

(iv) R.P.

$$U(EV - RP) = E(U)$$

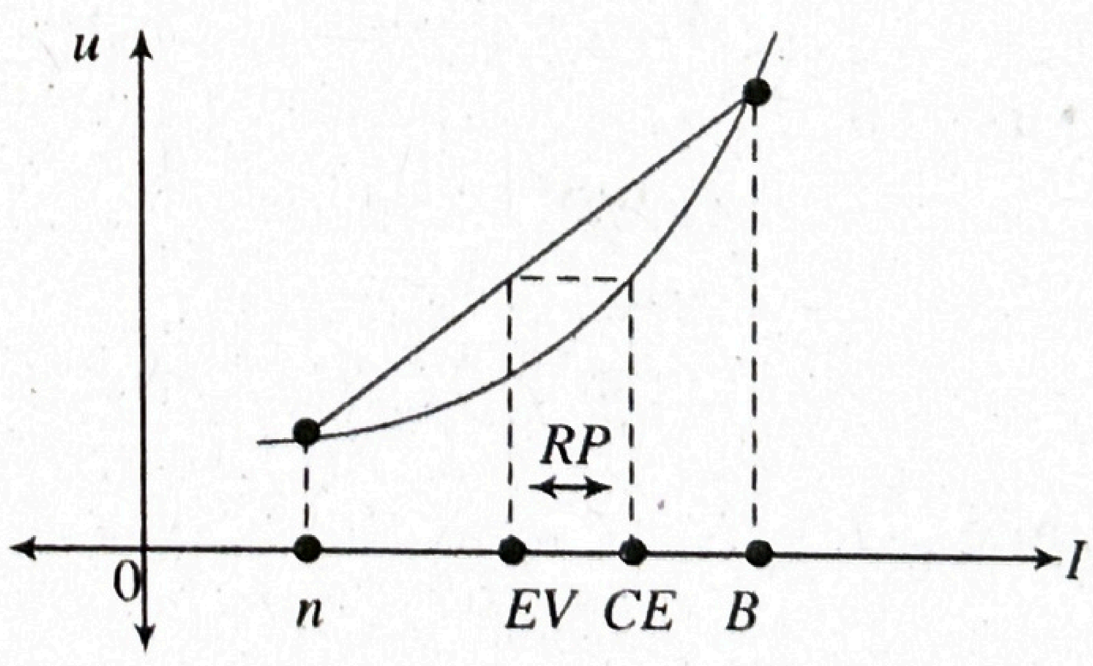
$\Rightarrow$ $U(200 - RP) = 80{,}000$

$\Rightarrow$ $(200 - RP)^2 = 80{,}000 \because u = x^2$

$\Rightarrow$ $200 - RP = \sqrt{80{,}000}$

$\therefore$ $RP = 200 - \sqrt{80{,}000}$

(v) Below diagram shows RP and CE for a Risk lover person.



(vi) $AP = \frac{-U''}{U'} = \frac{(-)(2)}{2x} = \frac{y-1}{x}$

SECTION B

Q. 5. (a) For a multiple output producing firm, the inverse production function, with one input x and two outputs $y1$ and y_2, is given as:

$$x = y_1^2 + y_2^2 + y_1 y_2.$$

(i) Given two vectors of output (2.4) and (4.2), prove that the inverse production function is stricity convex.

(ii) Check the monotonicity of the inverse production function.

(iii) Suppose the firm now decides to produce only one output such that the inverse production function takes the form: $= y^{2}$, assuming $x \geq 1$. Find the firm's input demand function when unit price of the output is $p =$ ₹ 5.

3,2,6

Ans. (i)

$$\text{For } (2, 4);\ x = 28$$

$$\text{For } (4, 2);\ x = 28$$

$$\text{For } \left(\frac{2+4}{2}, \frac{4+2}{2}\right);\ x = 27$$

So, $\dfrac{28+28}{2} > \left(\dfrac{2+4}{2}, \dfrac{4+2}{2}\right)$, convexity proved.

(ii)

$$\frac{\partial x_1}{\partial f_1} = 2y_1 + y_2 > 0$$

$$\frac{\partial x_2}{\partial f_2} = 2y_2 + y_1 > 0$$

(iii)

$$VAP = 5x^{-1/2}$$

$$VMP = \frac{5}{2}x^{-1/2}$$

VAP is max. at $x = 1$

Maximum $VAP = 5$

For $w > 5$, input demand $= 0$

For $w \leq 5$,

$$w = VMP$$

$$x = \left(\frac{2.5}{w}\right)^2$$

When $w = 0$, x is infinite

Thus, $x = \left(\dfrac{2.5}{w}\right)^2$, for $w \in (0, 5)$

(b) using an example explain if it is possible for a production function to exhibit diminishing rate of substitution and decreasing returns to scale at the same time. **4**

Ans. Using any example of production finction,

DRS and $\dfrac{d\,(MRS)}{dx_1} < 0$

Q. 6. (a) The production function of a firm producing mobile phone covers is given as:

$$q = (k^{1/3} + l^{1/3})^3$$

Here k is the amount of capital employed and l is the amount of labour hours employed and q is total output. The wage rate is w = ₹ 1 per hour and rental cost of capital is v = ₹ 4 per unit.

(i) Does this production function exhibit IRS, CRS or DRS?

(ii) Derive the conditional factor demands and use them to find the long-run cost function for this firm.

(iii) Derive and draw the firm's long run supply curve.

(iv) Suppose the firm is creating noise pollution. If the government is deciding whether to impose a lumpsum tax of ₹ T on the firm or to impose a fine, ₹ t per unit of output, which will have more impact on the output of the firm? **1,4,3,2**

Ans. (i) $[(\lambda K)^{1/3} + (\lambda l)^{1/3}] = \lambda q$; CRS

(ii)

$$MP_l = 3(K^{1/3} + l^{1/3})\frac{1}{3}l^{-2/3}$$

$$MP_k = 3(K^{1/3} + l^{1/3})\frac{1}{3}K^{-2/3}$$

$$TRS = \frac{w}{v}$$

$$\left(\frac{K}{l}\right)^{2/3} = \frac{1}{4}$$

$$l^* = \frac{8}{27}q$$

$$K^* = \frac{q}{27}$$

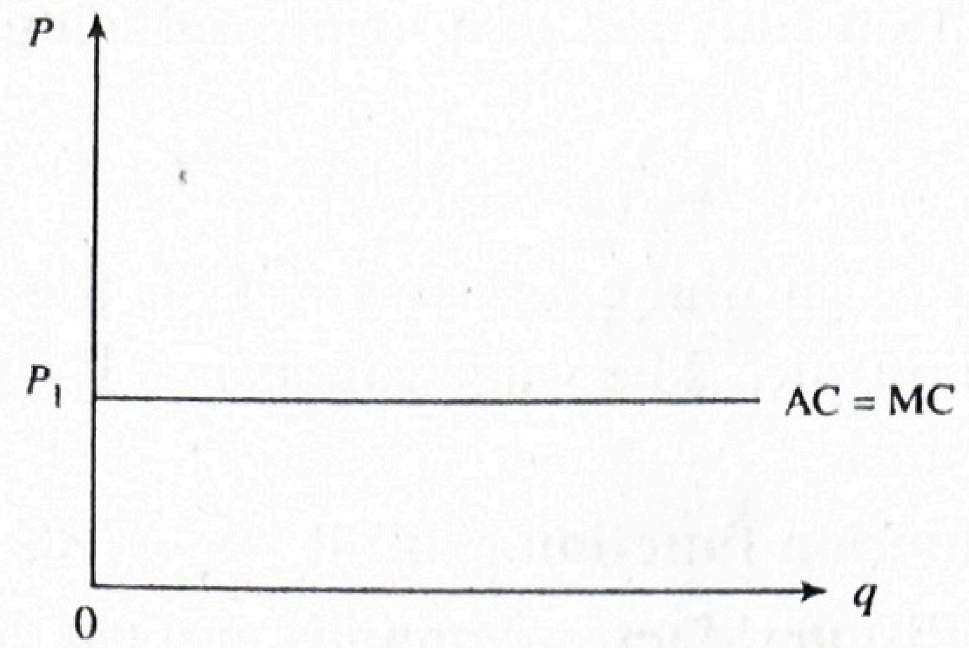
$$C^* = \frac{4}{9}q = 0.444\,q$$

(iii) CRS, so $AC = MC = \frac{1}{3}$

If $P < \frac{1}{3}$, supply = 0

If $P = -$, Firm will supply any quantity

If $P > \frac{1}{3}$, Firm will supply unlimited quantity.



For $P < P_1$; $q = 0$

For $P \geq P_1$; Supply curve is horizontal at the given price.

(iv) Lumpsum Tax (*T*)

$$C = \frac{4}{9}q + T$$

$$\pi = pq - \frac{4}{9}q - T$$

$$\pi \text{ max. at } P = MC, \text{ But } AC = \frac{4}{9} + \frac{T}{q}$$

$$P = \frac{4}{9}$$

Here $P < AC$, so $\pi < 0$, firm will stop production.

Unit output fine (*t*)

$$C = \frac{4}{9}q + tq$$

Here, $$AC = MC = \frac{4}{9} + t$$

So, $$P = AC$$

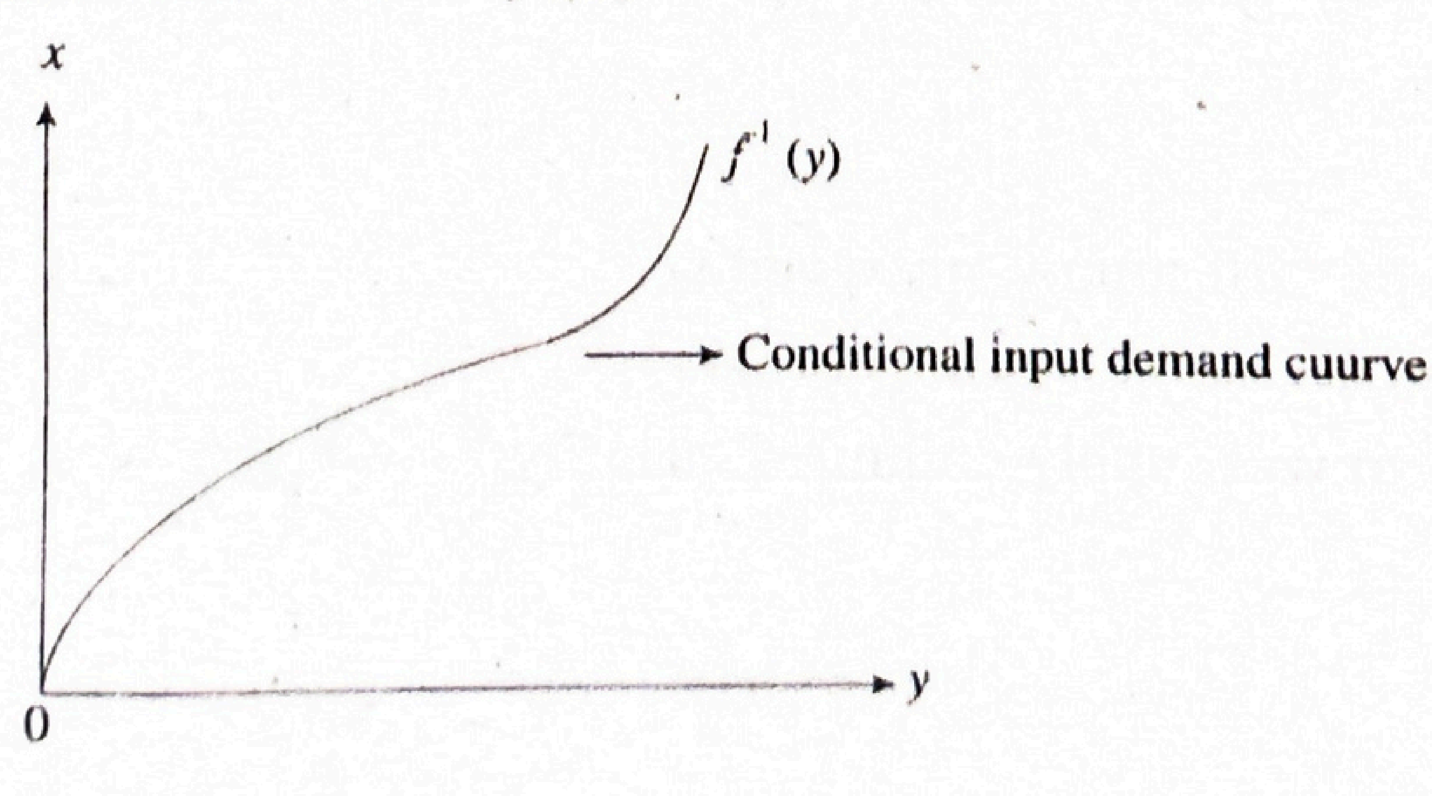
Firm earns normal profit

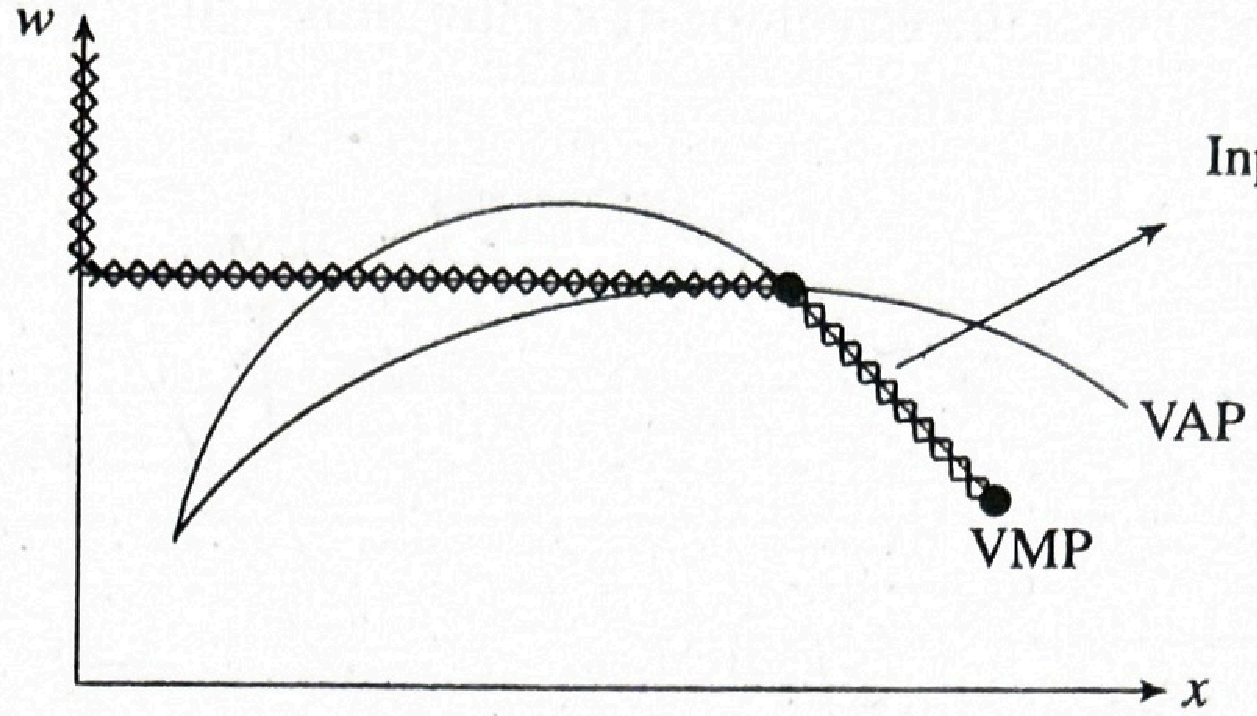
Lumpsum tax is more effective.

(b) What is the difference between input demand and conditional input demand? Explain using graphs. 5

Ans. Conditional Input demand; $x = f^{-1}(y)$

Input demand; $x = f(w)$





Q. 7. (a) Consider a profit-maximizing firm with the production function given as:

$$q = k^{1/4} l^{1/3}$$

The factor prices of labour (l) and capital (k) are w_l = ₹ 160 and w_k = ₹ 200 rspectively. Assume that amount of capital is fixed as 1 unit in the short run.

(i) Derive the short-run cost function.

(ii) Find the short-run supply curve of the firm.

(iii) What will be the loss of the firm if it decides to discontinue production?

(iv) If both the inputs become variable, then using a graph, show the long run supply of this firm. Also shade the profit of the firm at a particular per unit output price P^*. 2,5,1,4

Ans. (i)

$$q = l^{1/3}$$

$$C^* = 160\, q^3 + 200$$

(ii)

$$TVC = 160\, q^3$$

$$AVC = 160\, q^2$$

AVC min. at $q = 1$; min. $AVC = 160$

For $P < 160;\ q^s = 0$

For $P \geq 160;\ P = MC = 480\, q^2$

$\therefore$

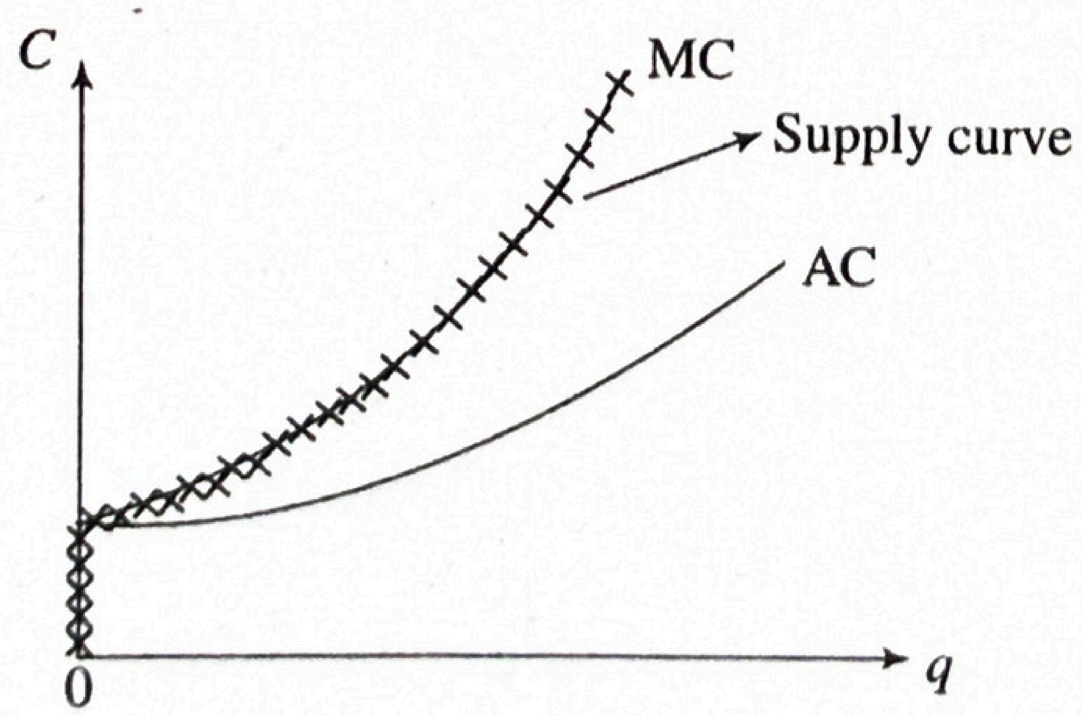
$$q = \sqrt{\frac{P}{480}}$$

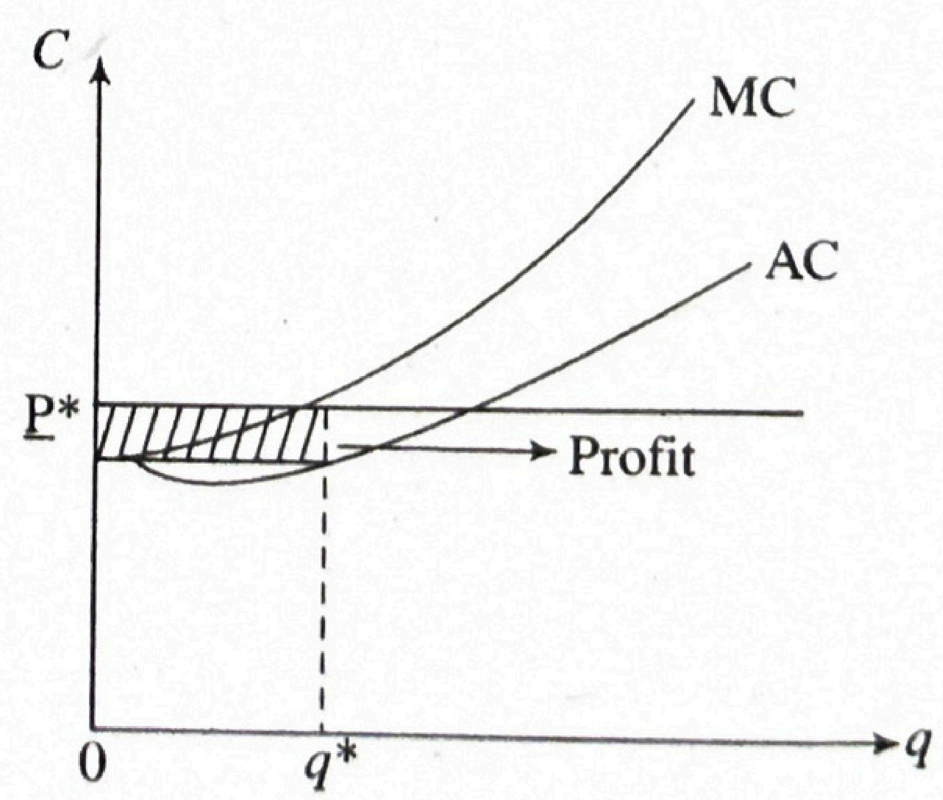
$$\frac{dMC}{dq} = 960\, q > 0; \text{ So, } MC \text{ is rising}$$

(iii)

$$\text{Loss} = FC = 200$$

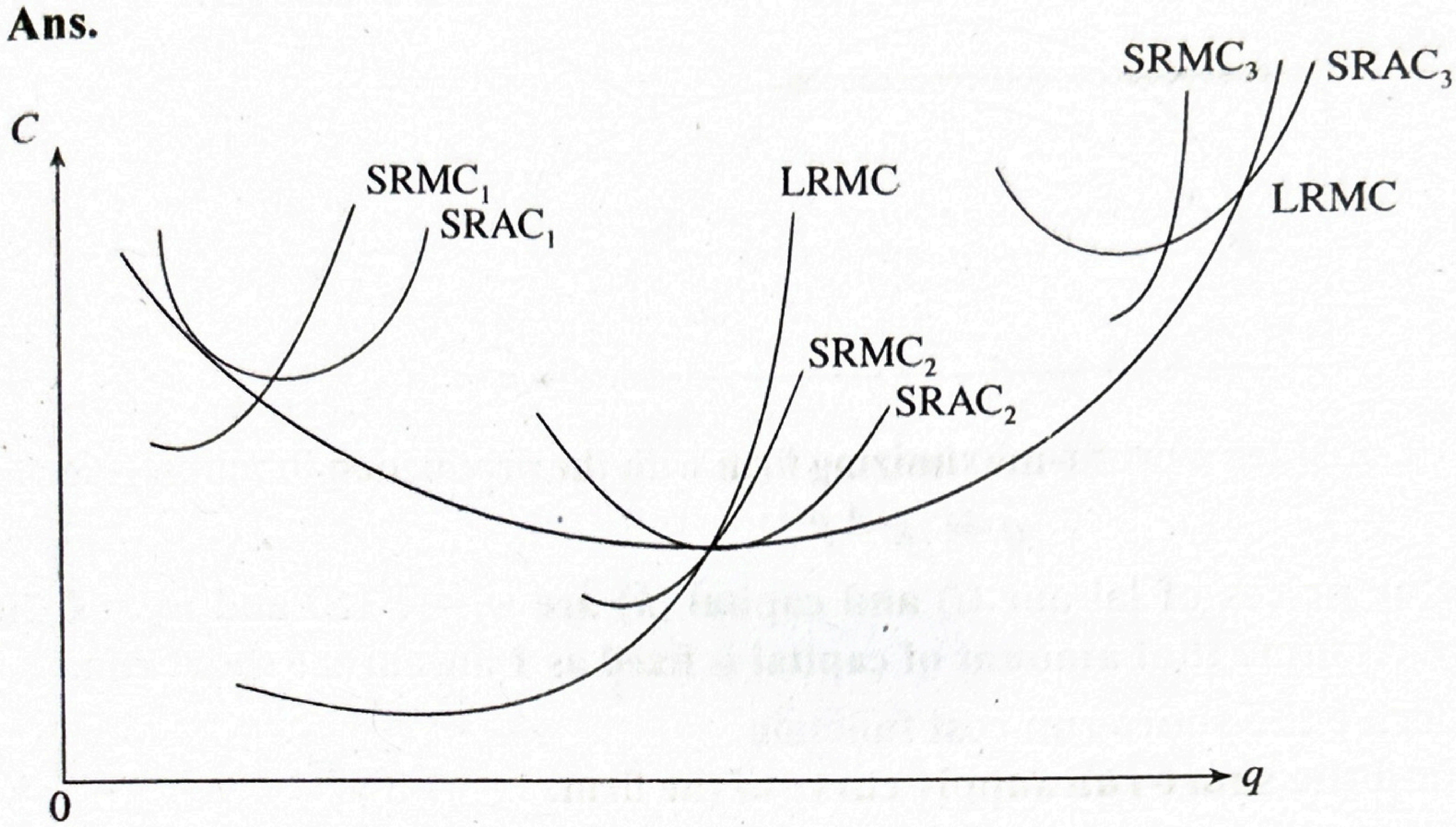
(iv)





(b) "The long-run cost curve is the envelope of all the short-run curves". Explain this statement with the help of a graph. 3

Ans.



The long-run average cost curve (LARC) is often called the enveop of all the short-run average cost curves (SARC), because it is formed by enveloping various short-run curves, as dipicted in the abive graph. There are many short-run period in the long-run. And each short-run has its own equilibrium when all short-run equilibrium is combined, the single long-run cost curve is formed.

□□□