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Economics.

Oikai (Household) | Nemein (Management)

"Adam Smith" father of economics. He has given the definition of economics in 1776.

→ Economics is the study of wealth - Production, consumption, distribution

The book written by him "An enquiry into the nature & causes of wealth of a nation".

- Wealth : Production, consumption, distribution
- Nature : visible things.
- Causes : Demand, Supply.

Dr. Marshell gave the second definition stating: "Study of wealth which is used for welfare of society." It is the welfare definition of economics. He has given this definition in 1890 in his book "Princi-ples of Economics".

Economics is the study of mankind in ordinary business of life. It examine that part of individual & social action which is most closely connected with the attainment & use of material requisites of well-being

- Social science
- Ordinary
- Nature of goods (material goods)
- Money

- Scarcity (Definition given by Dr. Robbins in 1931) : The book written by him in 1931 : It is a study of human behaviour as a relations-hip b/w "ends and scare means" which have alternative uses.

Growth Theory : (Given by Dr. Samelson) features :—

- Economic growth

__/__/____

- Effective & efficient utilisation of resources.
- It is universal & dynamic in nature.

Economics

It is the branch of knowledge dealing with production of wealth for the welfare of society by using limited resources effectively & efficiently to fulfil unlimited bond of human being which will lead to economic growth & development.

RELATION OF ECONOMICS AND ENGINEERING

- use of machine
- Infrastructure
  - → less i/p more o/p
  - → same i/p more o/p
  - → less i/p same o/p

ENGINEERING ECONOMICS.

Engineering economics deals with methods that enable anyone to take economic decision towards minimising cost & maximising benefit to organisation.

Cardinal view, ordinal view
↓ ↓direction
no. dependant 09/07/13 deper-dent

* UTILITY.

AU ⇒ Qty. 3 = 18
18/3 = 6.

1. Total 2. Average 3. marginal.

Q	TU	MU.
1	10	10
2	16	6
3	16	0
4	18	-2
5	19	-1

Addition to the total utility by consuming one more unit of a product.

$MU = TU_n - TU_{(n-1)}$

$= \frac{\Delta TU}{\Delta Q}$

Law of Diminishing marginal utility.

When the consumer goes on consuming a particular commodity one after another addition to TU (MU) goes on diminishing.

[Fully satisfied with product MU = 0 then after -ve in no

* DEMAND *

Desire for a commodity when the consumer has ability & willingness to pay for the product.

factors of demand.

$D_x^d = f(P_x, P_R, Y, H, F, E \ldots)$

P_x: Price of goods

P_R: Price of related goods.

1. Substitute goods
   Demand of one is depend on price of other
   $\uparrow P_T \rightarrow D_c^d$
   Tea & coffee.

2. complementary goods (Join)
   The other thing is not preferred if one is not there!
   Tea & milk
   car, petrol.

H: Habit F: Fashion, Preferences./Taste Y: Income.

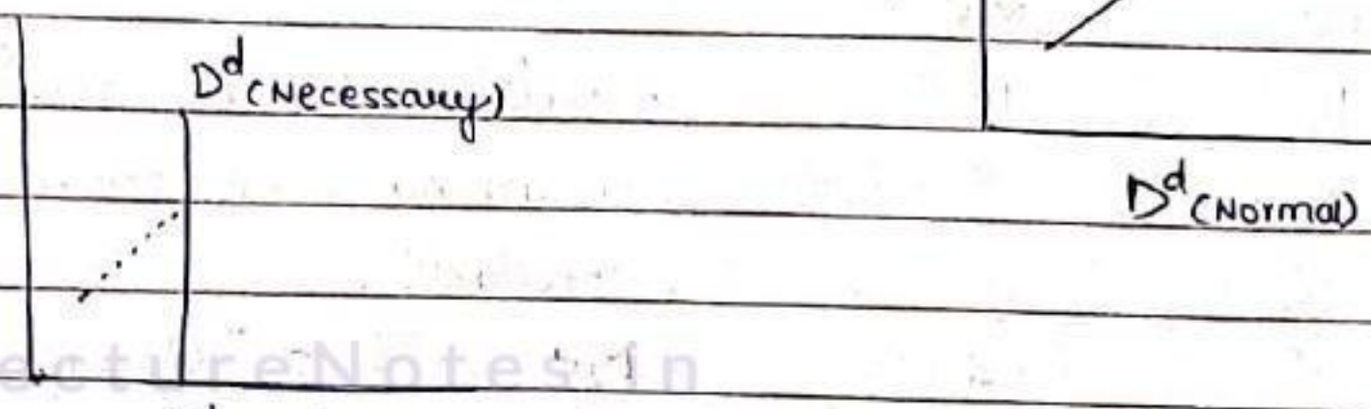
E: Expected price in future.
Change in price of gold, petrol.

29/07/19

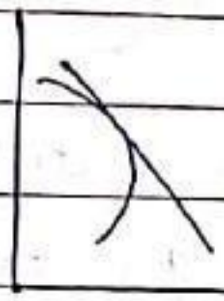
Determinants Y: Income

of demand * ~~UTILITY~~ → Normal goods.

→ Necessary products Y



→ Inferior goods.



Downwards or backward relationship.

* LAW OF DEMAND [DEMAND THEORY]

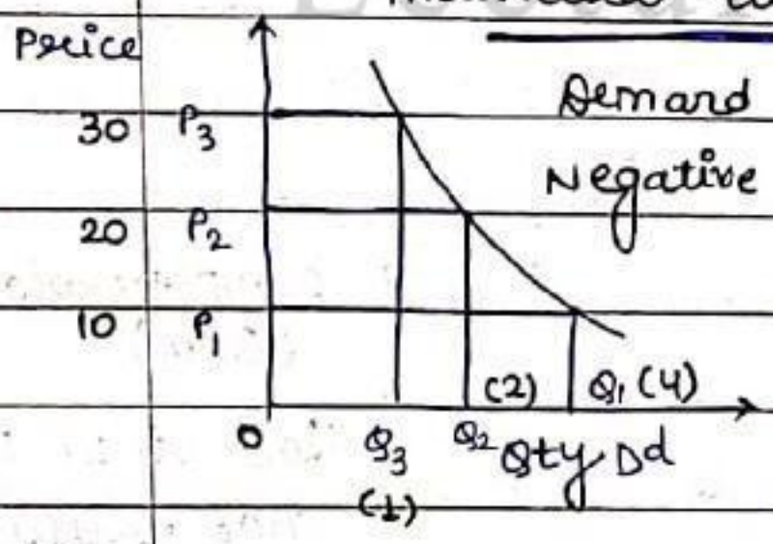
Other things remain constant, there exists an inverse relationship b/w price and qty. demand of a product.

1. INDIVIDUAL DEMAND

Quantity of a product purchased by individual consumer at different prices at a given time period.

Individual demand schedule.

	P_x	D^d_x
(A)	10	4
	20	2
	30	1.



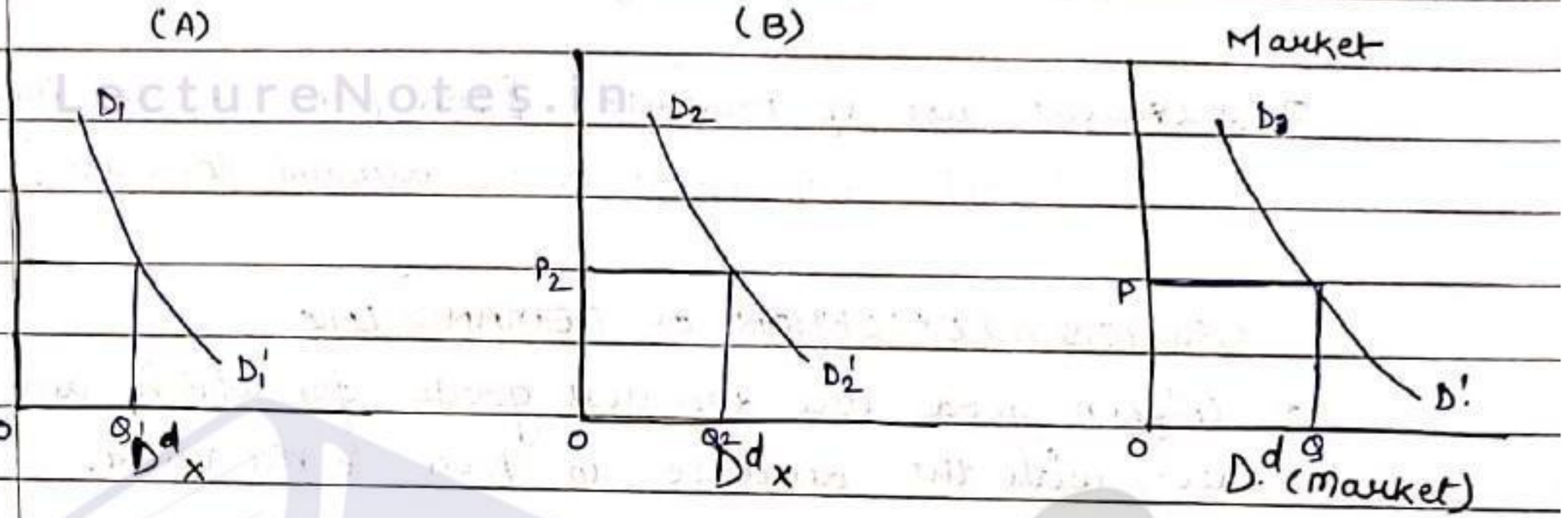
Demand curve is Negative slope (downward slope)

2. MARKET DEMAND

Quantity of a product purchased by all consumers in market at different prices at a given time period.

__/__/__

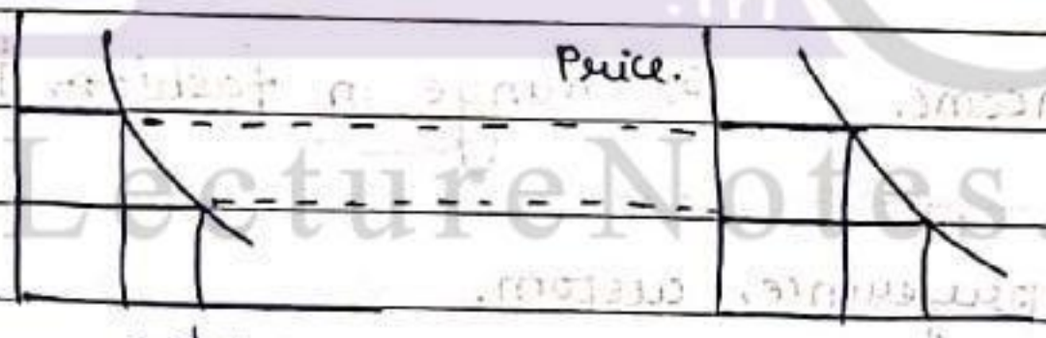
	(A)	(B)	
P_x	D^d_x	D^1_x	Market D^d.
10	4	5	9
20	2	4	6
30	1	2	3



$OQ = (OQ_1 + OQ_2)$ at P.

Q. Why demand curve is -ve slope.

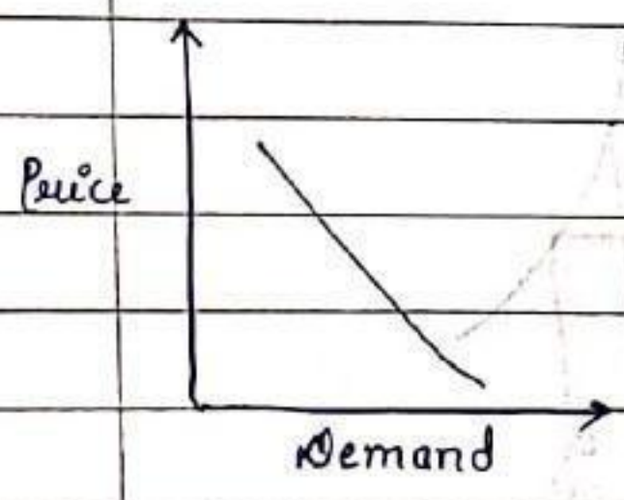
i) Due to diminishing MU.



ii) Income effect : Due to the real income, there exists inverse effect b/w price & demand.

Real income increase if price decreases resulting in increase of demand.

[Money left after all purchase is real income]



Real income ↑ → D^d ↓
(inferior goods)

3> Substitution effect.

D^d_x ↓ P_y ↑   X ⤻ Y

Y: Price is less
X: Price is more.

4> Size of population (No. of consumer)

5> Different use of products. [Low price → use increases demand increases]

CRITICISM / EXCEPTION OF DEMAND LAW.

1> Giffen goods are inferior goods for which demand decreases with the decrease in price & vice versa.

2> Veblen goods are prestigious goods for which demand increases with the increase in price.

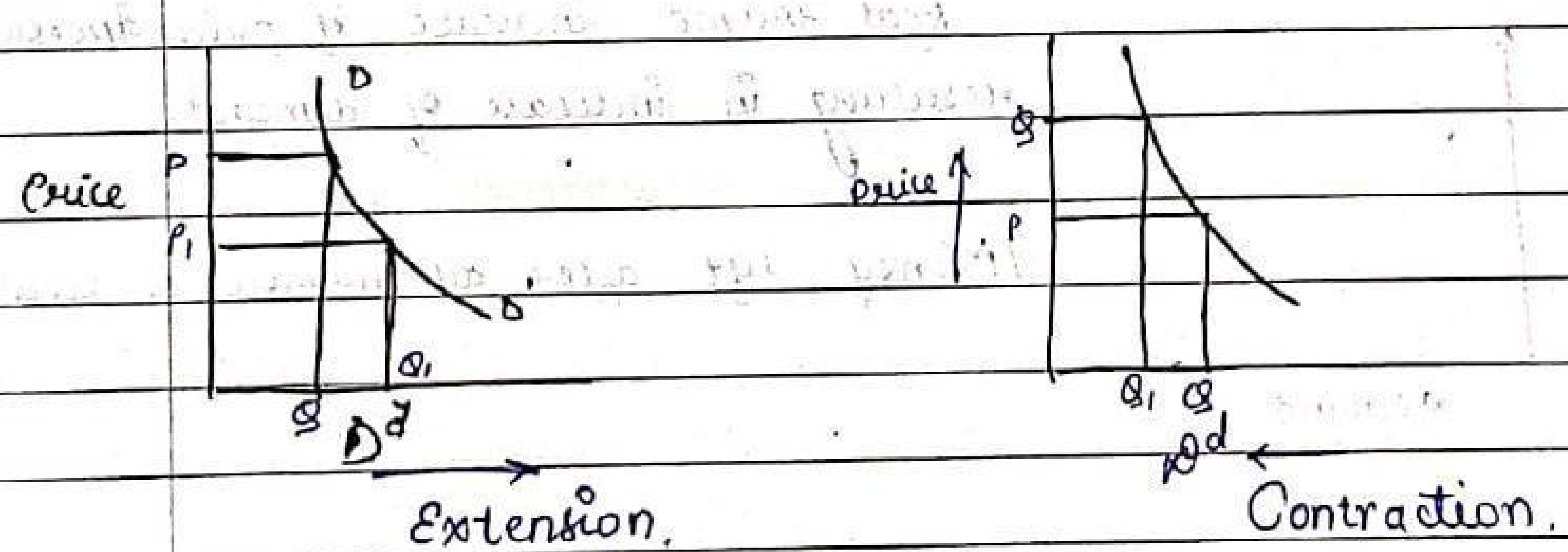
3> Shortage of product in market though demand is more.

4> Change in income.   5> change in fashion, habit

6> Change in preference, custom.

7> Change in future expected price.

EXTENSION: With the change (↓) in price demand will increase. This is the case of extension in demand.



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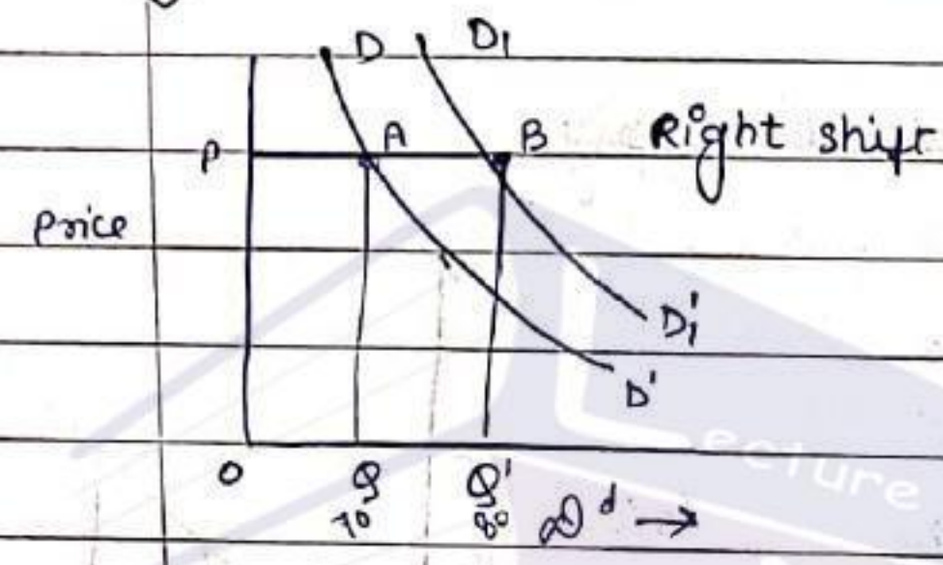
With the change in price, demand will decrease. This is the case of contraction in demand.

* INCREASE AND DECREASE

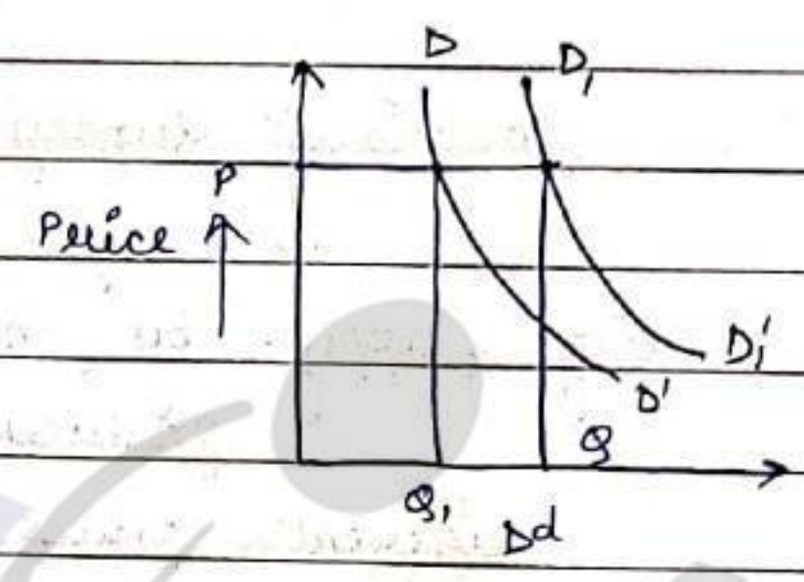
There is increase in demand due to the changes in other factors (P, E, H, F, C)

→ In which case demand curve will shift.



Right shift

Increasing.



Decreasing

* SUPPLY *

Opposite of demand. Production / availability of goods. This is producer's theory.

Production + Price

i) Price of product: (Direct relation b/w supply & price)

ii) Technology : Better technology production more.

iii) I/p prices : land, labour, capital, organisation
factors of production.

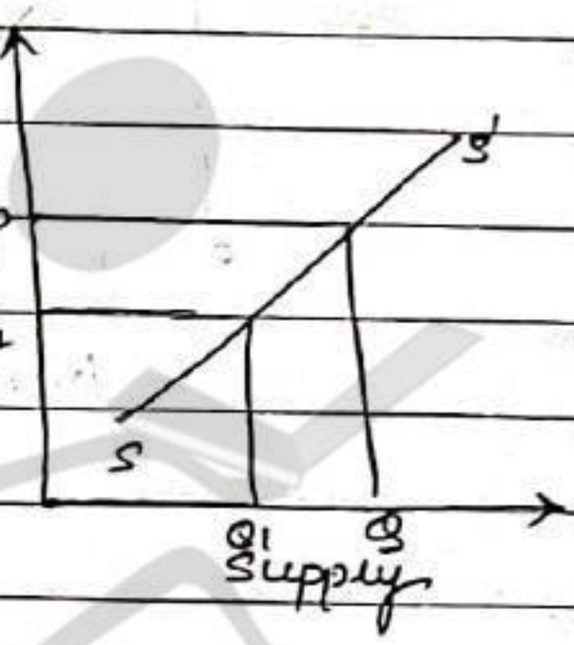
More i/p price → less supply
[Inverse relation]

__/__/____

iv) Govt. policies : Tax & Subsidy ⟶ contribution of govt. for public.
↓
Compulsory contribution by the public for betterment of nation
↓ tax — ↑ production

v) Price of related goods : Complements & Substitute.

Individual supply & market supply
↓
Qty. Supply by an individual producer at different prices at given time period.

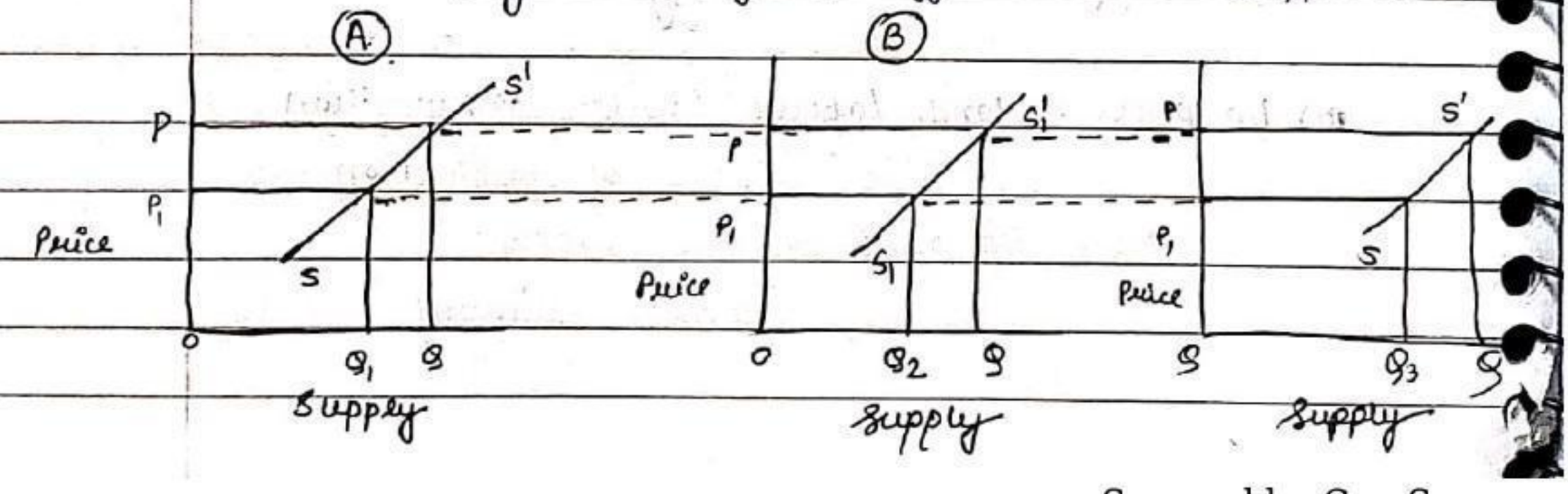


* SUPPLY THEORY

Other things remain constant, there exist a direct relationship b/w price & quantity supply of product.

Individual supply :- Supply of individual supplier. 15 JUL'19

Market supply :- Supply by different market suppliers.



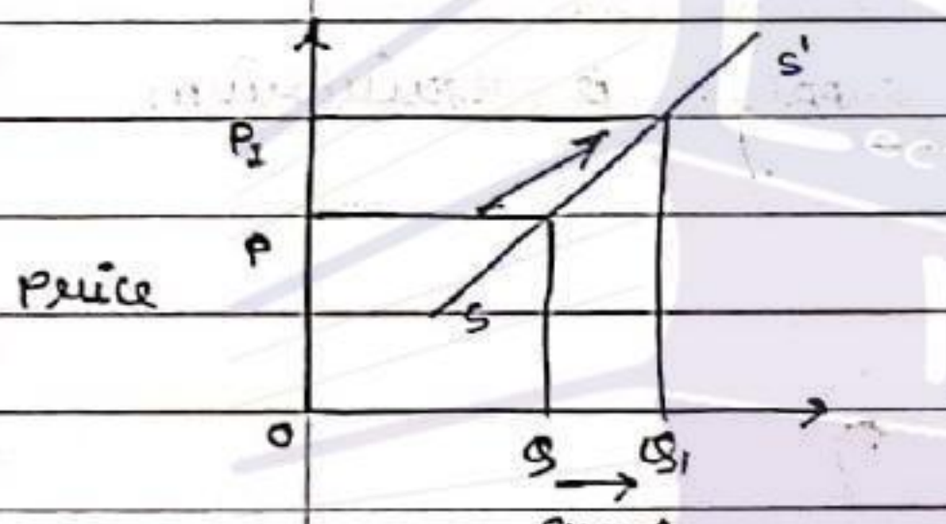
P	S_c(A)	S_c(B)	S_c(market)
30	4	5	9
20	3	4	7
10	2	1	3

$OS_3 = OS_2 + OS_1$

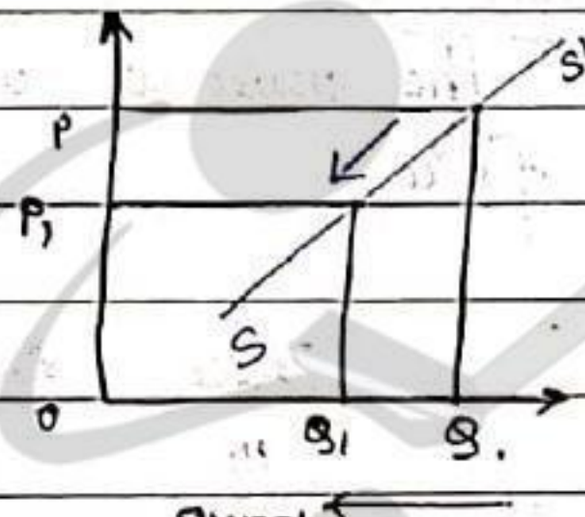
* EXTENSION AND CONTRACTION

With the change in price the supply will change, if it increases known as extension.

If it is diminishing known as contraction in supply.



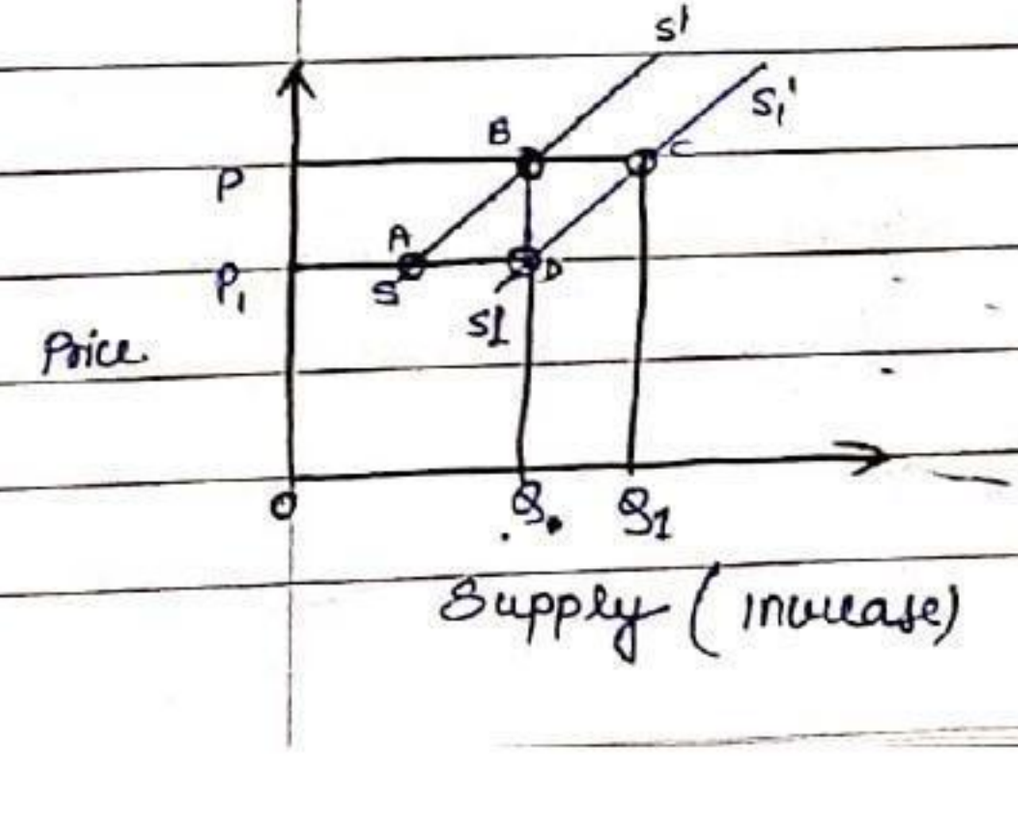
Extension



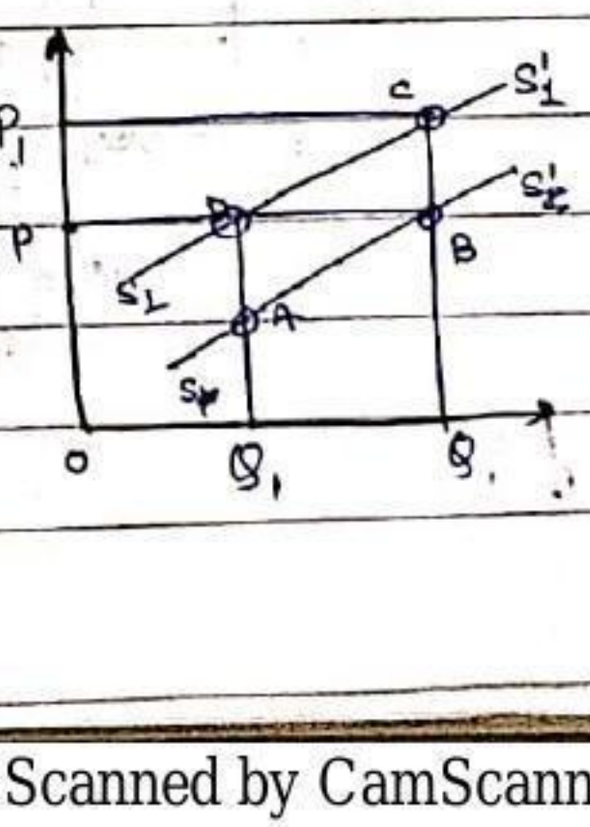
Contraction

* INCREASE AND DECREASE

Supply increases with the change in other factors of supply This is the case of increase in supply and the supply curve will shift downwards or forward.



Supply (increase)



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* Increase in supply → downward. shift
→ Same price more supply
→ Less price same supply

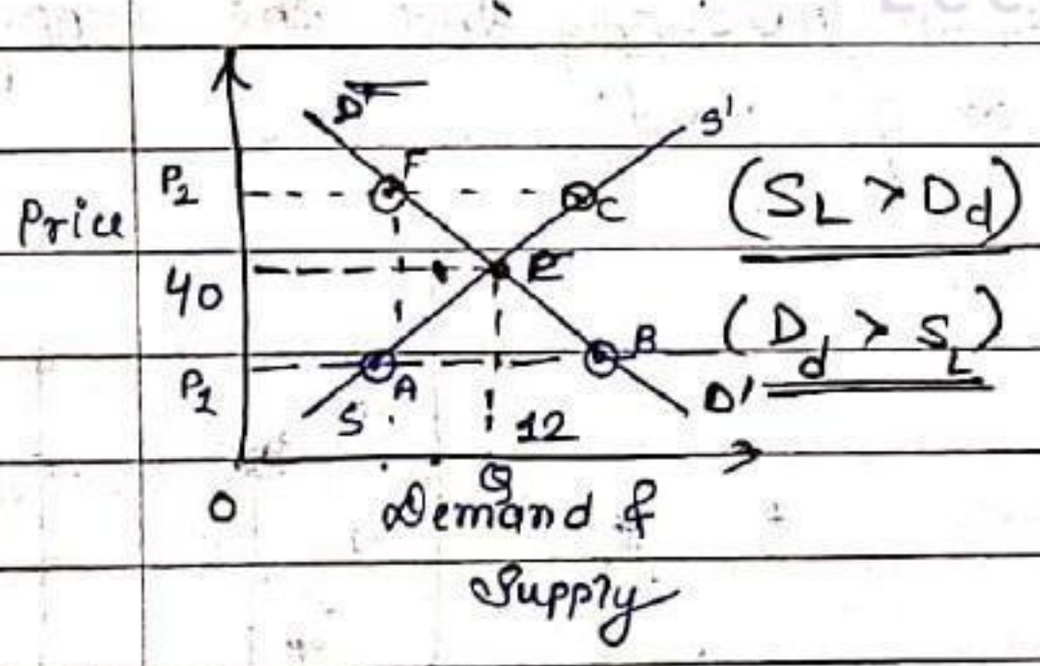
* Decrease in supply → upward. shift.
→ Same price less supply
→ More price same supply

* EQUILIBRIUM

Equilibrium price determination by the process of demand & supply.

The price at which demand = supply is equilibrium price.

Price	Demand	Supply	
10	24	2	$D_d > S_L$ Shortage
20	20	4	
30	16	8	
Equilibrium price & quantity ← 40	12	12	
50	8	16	$D_d < S_L$ Surplus.
60	4	20	
70	2	24	



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Q. $Q_d = 50 - 10P$

$Q_s = 30 + 10P$

Calculate equilibrium price.

$Q_d = Q_s$

$\Rightarrow 50 - 10P = 30 + 10P.$

$50 - 30 = 10P + 10P$

$20 = 20P$

$\Rightarrow P = 1$

$Q_d = Q_s = 10$

Tax of ₹5/unit imposed by govt. What will be the equilibrium price & quantity.

$Q_s = 30 + 10(P - 5).$

$= 30 + 10P - 50$

$= -20 + 10P$

$Q_d = 50 - 10P$

$\Rightarrow Q_d = Q_s$

$-20 + 10P = 50 - 10P.$

$20P = 70.$

$P = \frac{70}{20}$

$\boxed{P = 3.5}$

$Q_d = 50 - 10 \times 3.5$

$= 50 - 30.5$

$= 19.5.$

If subsidy is given by govt. ~~by~~ is ₹5. Calculate equilibrium price

$Q_s = 30 + 10(P + 5)$

$= 30 + 10P + 50, = 80 + 10P$

__/__/____

$Q_S = 80 + 10P$

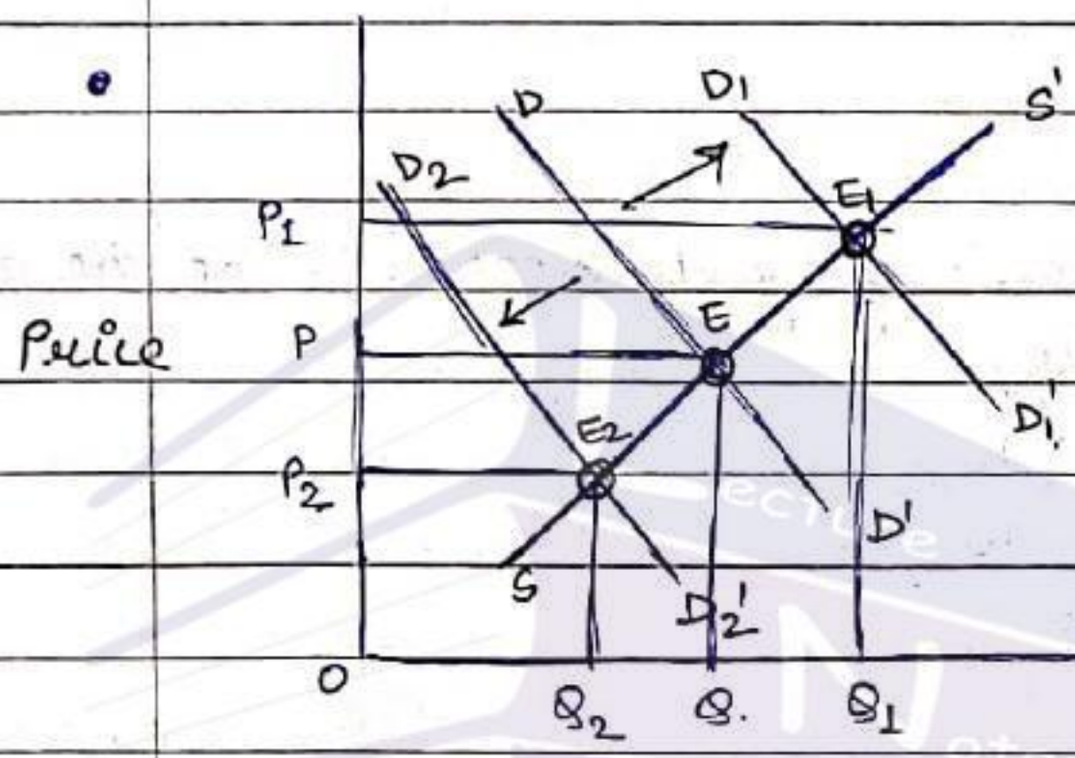
$Q_D = 50 - 10P.$

$80 + 10P = 50 - 10P.$

$30t = -20P.$

$P = -1.5$

* Change in D^d & S_L, effect on equilibrium price 16 JULY'19

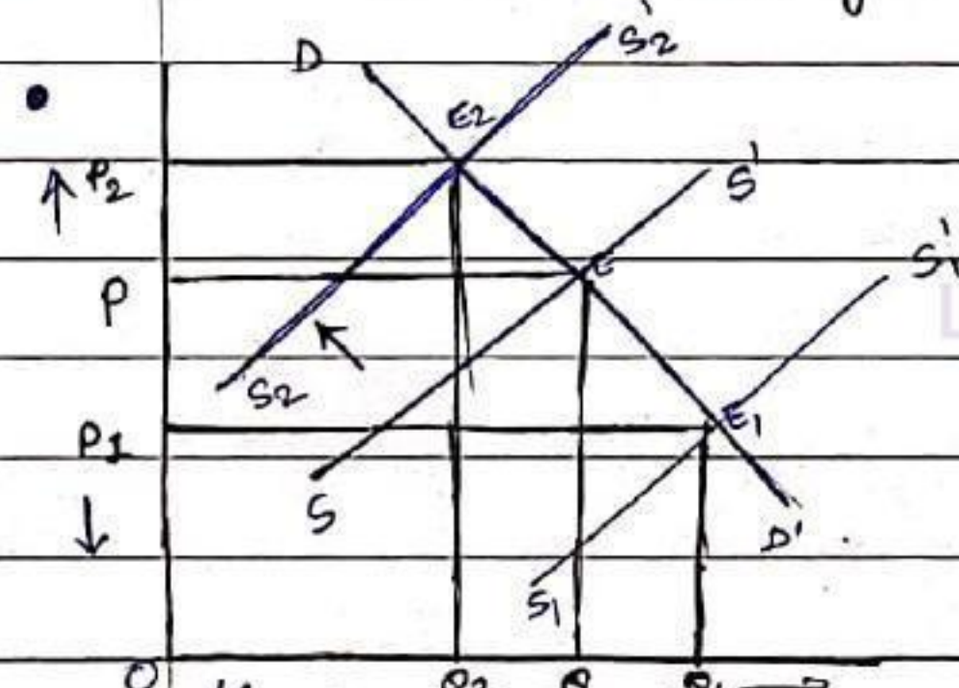


D^d	S_L
50	50
P↑ 70	> 50
30	< 50 P↓

D_d and S_L

Change in demand & supply effect on equilibrium price.

Keeping supply constant, change in demand varies price directly with change in quantity.

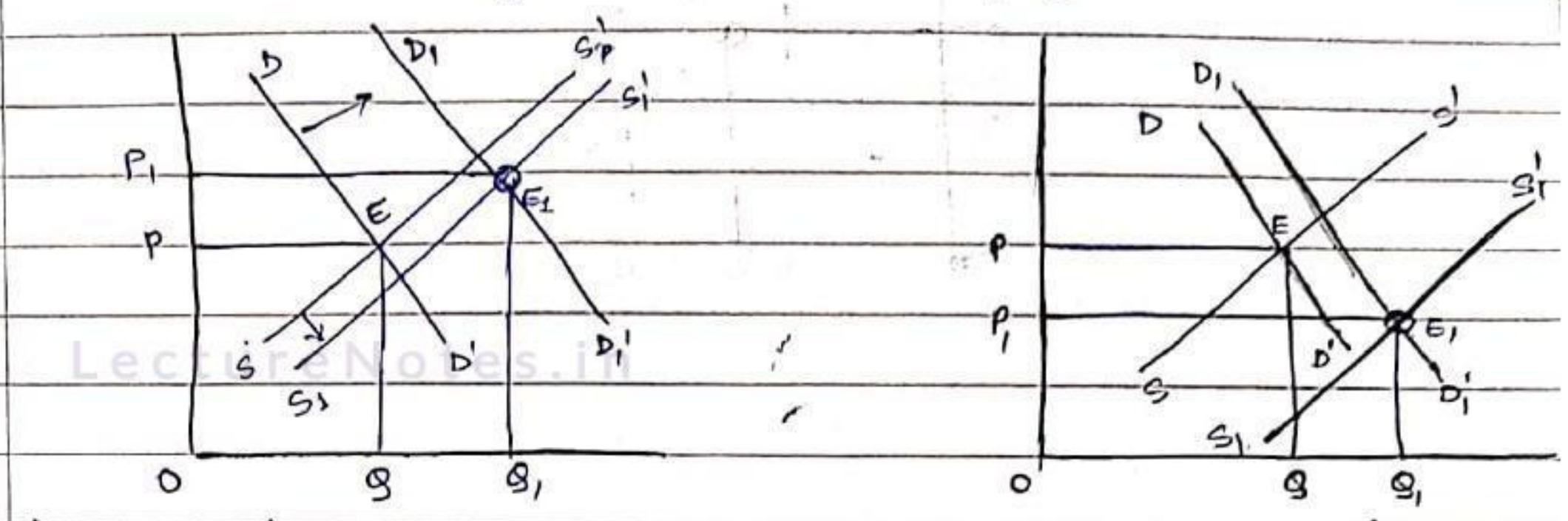


Keeping demand constant if there is change in supply price changes in opposite direction to change in quantity.

Minimum support price (MSP)

__/__/__

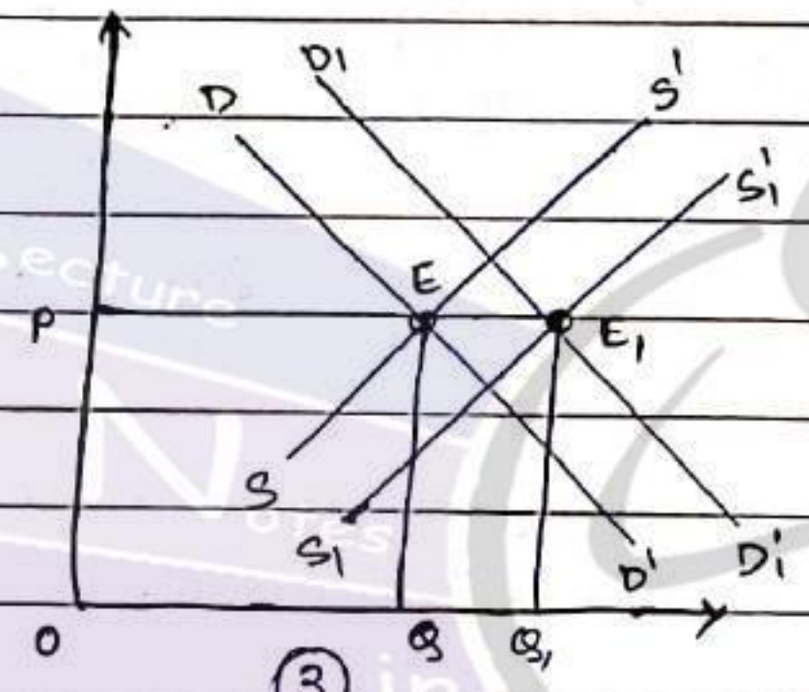
- Simultaneous change in demand & supply.



$\Delta D^d > \Delta S_L$ (1)

$\Delta D^d < \Delta S_L$

(2)



$\Delta D^d = \Delta S_L$

(3)

1. If $\Delta D^d > \Delta S^L$, price changes in the same direction with the change in qty.

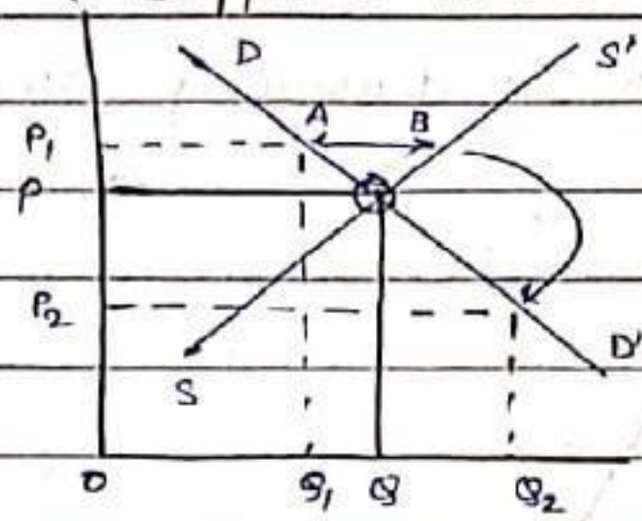
2. $\Delta D^d < \Delta S_L$, price changes in opposite direction to change in qty.

3. $\Delta D^d = \Delta S_L$, price will remain constant.

1. D^d	S_L		2. D^d	S_L		3. D^d	S_L
50	50		50	50		50	50
80	> 60	P↑	60	< ~~70~~	P↓	60	60.

__/__/____

* Minimum Support Price (MSP)



16 July'19

* ELASTICITY *

Degree responsiveness change in quantity demand due to the change in price, income of the consumer & price of the related goods is known as elasticity of demand.

1. Price elasticity of Demand (E_p^d). 18 JULY'19

Degree responsiveness change in quantity demand due to the change in price is known as price elasticity of demand.

$$E_p^d = \frac{\% \text{ change in qty } D^d.}{\% \text{ change in price}}$$

$$= \frac{\Delta Q/Q \times 100}{\Delta P/P \times 100}$$

$$\boxed{E_p^d := \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}}$$

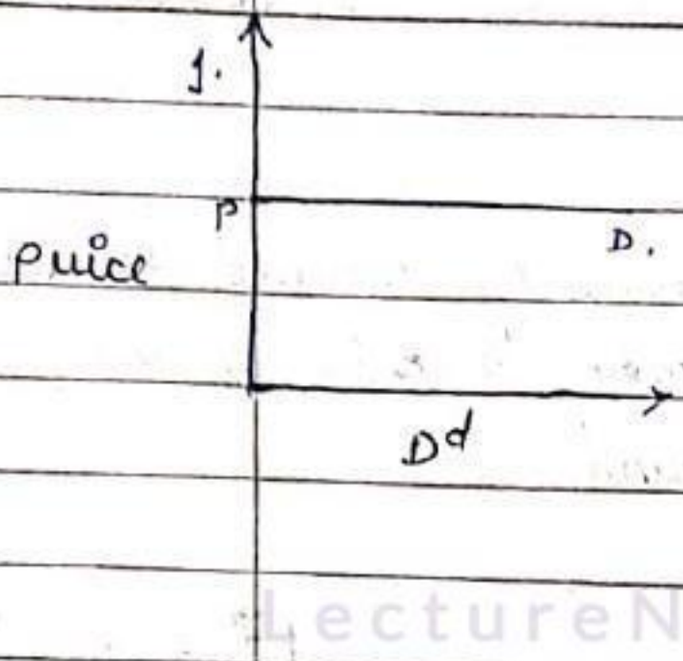
Inverse relation in Quantity and price make E_p^d -ve valued. [Hence modulus taken]

DEGREES of E_p^d

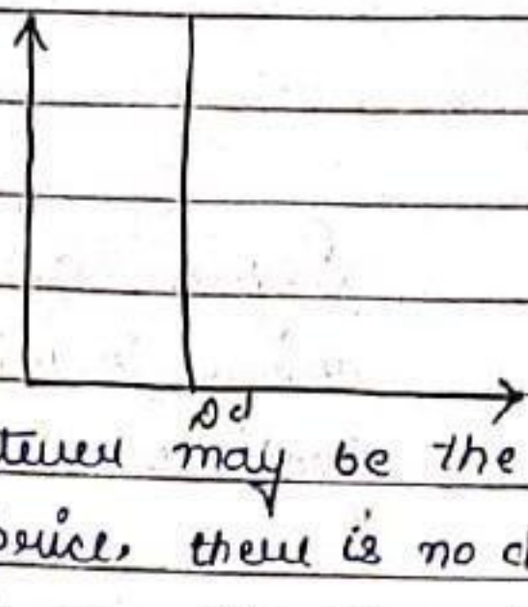
1. Perfectly elastic — $\boxed{E_p^d = \infty}$
2. Perfectly inelastic — $\boxed{E_p^d = 0}$
3. Unitary elastic — $\boxed{E_p^d = 1.}$
4. Relatively elastic — $\boxed{E_p^d > 1}$
5. Relatively inelastic — $\boxed{E_p^d < 1}$

__/__/____

1.



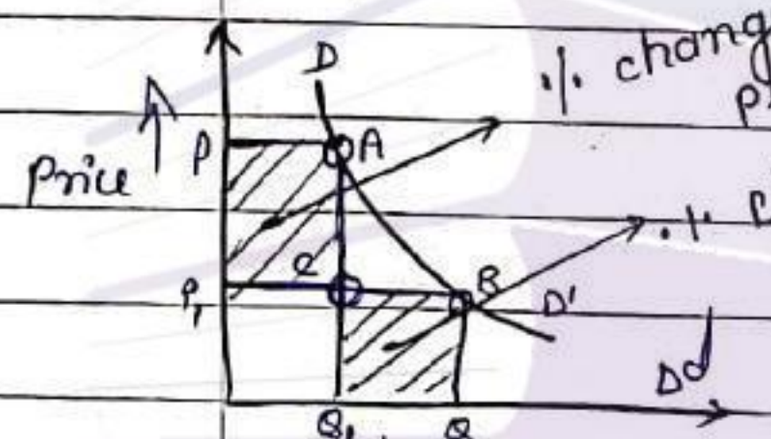
2.



Whatever may be the change in price, there is no change in quantity demand of a product.

With

3. The change in price demand changes equipro-portionately with change in price.



% change in price is equal to % change in quantity demand.

→ Comfortable goods.

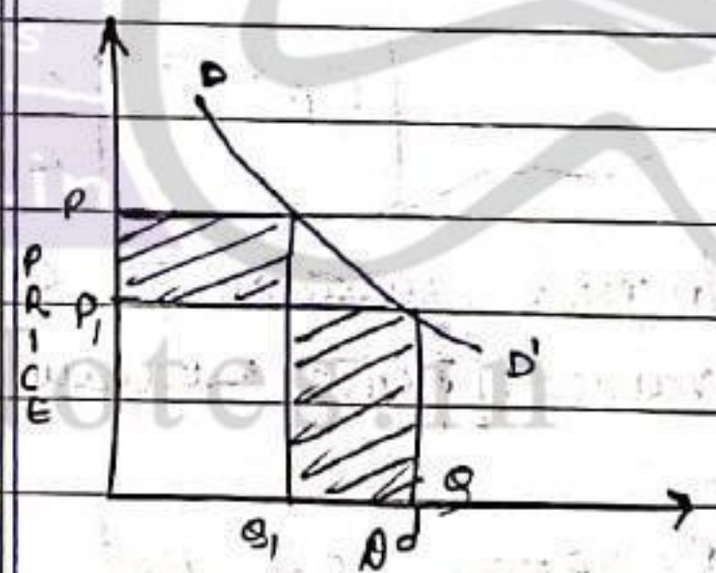
4.

With the change in price Dd varies in a greater proportion

OR

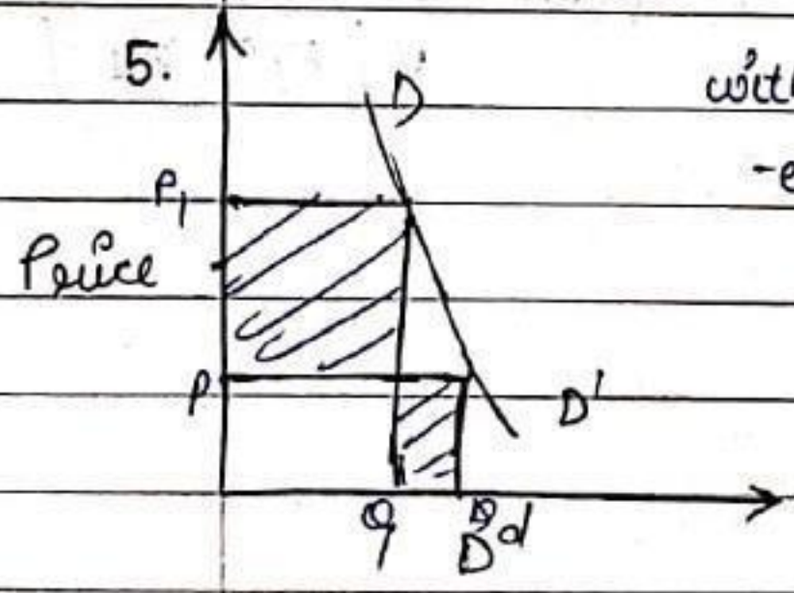
% change in d^d > % change in price.

The Dd curve is flatter curve.



$$E_p^d = \frac{\Delta Q}{\Delta P} \times \frac{P_m}{Q_m}$$

5.



with Change in price d^d varies less proportionately as compared to change in price.

OR

% ΔD^d < % ΔP.

Dd curve is a steeper curve.

2. Income elasticity of D^d (Ey^d)

Degree responsiveness change in quantity demand due to the change in income of the consumer.

$$Ey^d = \frac{\%\ \text{change in Qty } D^d}{\%\ \text{change in income.}}$$

$$= \frac{\Delta Q / Q \times 100}{\Delta Y / Y \times 100}$$

$$\boxed{Ey^d = (-)\frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q}}$$ [Negative value may be]

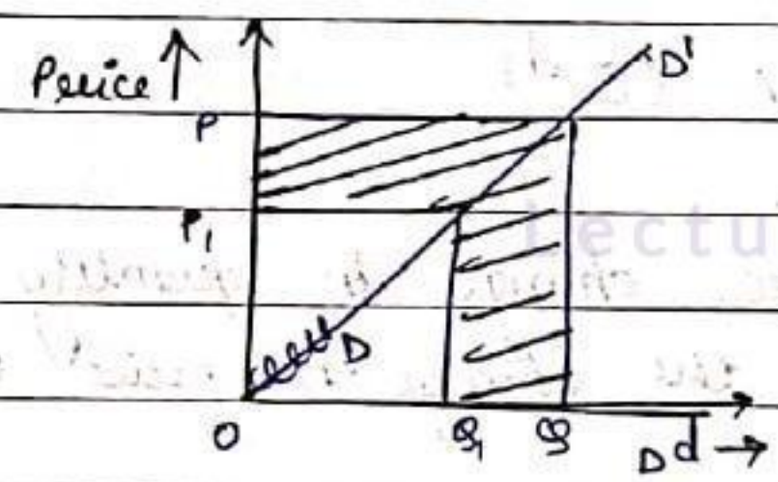
Can be 0 also.

→ Positive degree, Negative degree, zero degree

1. Positive degree $Ey^d > 0$

When we change the income of a consumer, D^d of the product changes ~~more proportionately~~ in the same direction with the change in income.

Income - Demand curve is upward sloping



Y	D^d
10	20
20	50.

$$Ey^d = \frac{30}{10} \times \frac{10}{20}$$

$$= \frac{3}{2} = 1.5$$

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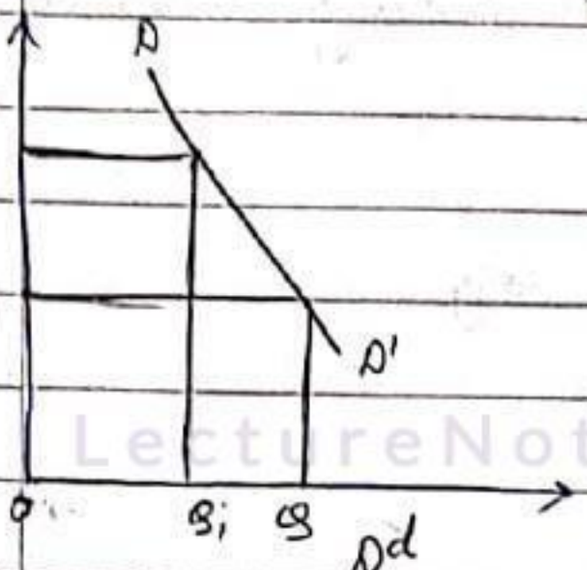
INCOME ELASTICITY (-ve)

22 JULY'19

$E_y^d < 0$ [Giffen goods]



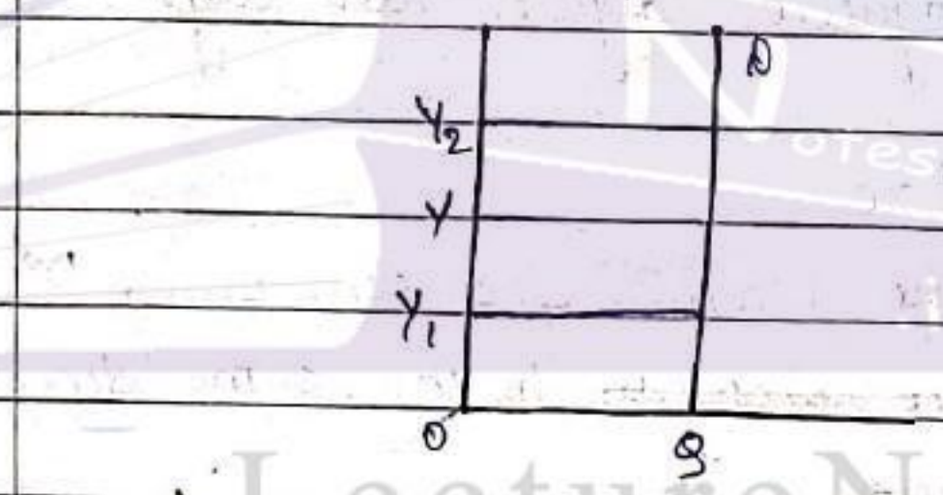
Y	Q
10	5
40	2.

Change in income, Dd varies inversely.

* ZERO DEGREE

or vice versa [parallel to x]

With the change in income there is no change in quantity demand and the demand curve going to be parallel with y-axis



Y	Q
10	20
40	20

This is the case of $E_y^d = 0$

CROSS ELASTICITY (E_c^d)

Degree responsiveness change in quantity demand of a product (X) due to the change in price of the related product (Y)

Good (Y)

Good (X)

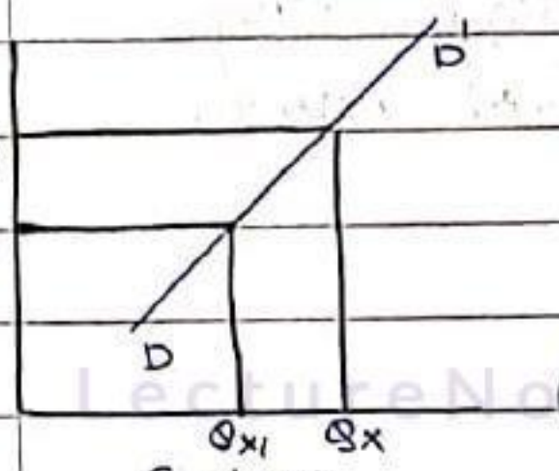
$$E_c^d = \frac{\%\text{ change in } X}{\%\text{ change in } Y}$$

$$= \frac{\Delta Q_x / Q_x}{\Delta P_y / P_y} = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

__/__/____

Following three degrees are

i) Positive ($E_c^d > 0$)



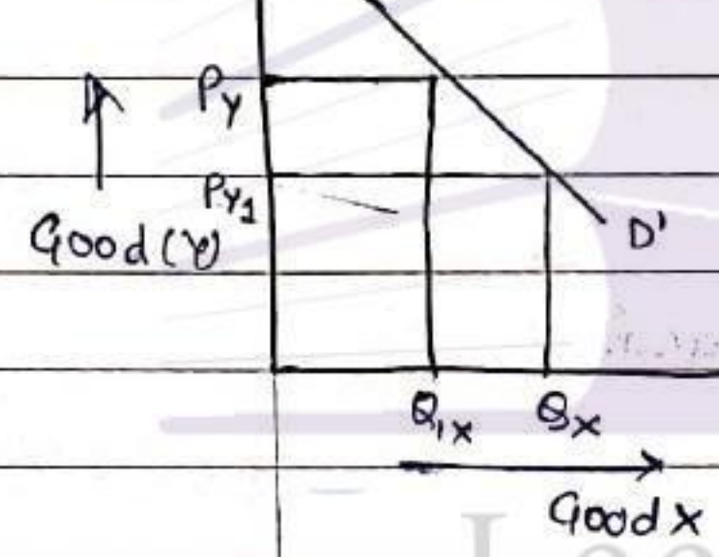
P	Q
50	10
20	5

(substitute / competitive goods.)

ii) Negative ($E_{cd}^d < 0$)

With the change in price of one product, dumand of related product changes inversely.

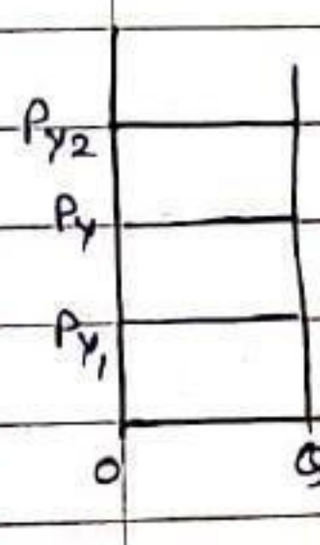
Complementary goods.



P	Q
50	1
20	5

iii) Zero ($E_c^d = 0$)

Change in price of 1 product there is no change in demand of another product. / or vice versa.



($E_y^d = 0$)

P_Y	D_x^d
10	20
40	20.

__/__/____

METHODS OF MEASURING Epd

1. % method.
2. Mid-point method.
3. Arc method
4. Expenditure method / total outlay method.
5. Point method.

→ Percentage method.

$$\frac{\Delta Q}{\Delta P} \times \frac{P_m}{Q_m}$$

→ Mid point method.

$$\frac{\Delta Q / \frac{Q_1+Q_2}{2} \times 100}{\Delta P / \frac{P_1+P_2}{2} \times 100} = \left| \frac{\Delta Q}{\Delta P} \times \frac{P_1+P_2}{Q_1+Q_2} \right|$$

Arc method

P	Q.
50	1
20	5

> 1 represents elastic demand.

$$\frac{4}{30} \times \frac{70}{6} > 1.$$

→ Arc ~~dem~~ method.

If 2 points are nearer to each other on demand curve we apply arc method of measuring elasticity.

$$\left| \frac{\Delta Q}{\Delta P} \times \frac{P_1+P_2}{Q_1+Q_2} \right|$$

P	Q
1	2
1.5	1

$$\frac{1}{0.5} \times \frac{2.5}{3} = \frac{2.5}{1.5}$$

__/__/__

Because 2 points are nearer to each other ! utilised.

Expenditure method.

$P \times Q = PQ$

$10 \times 5 = 50$

I. With the change in price, there is no change in expenditure

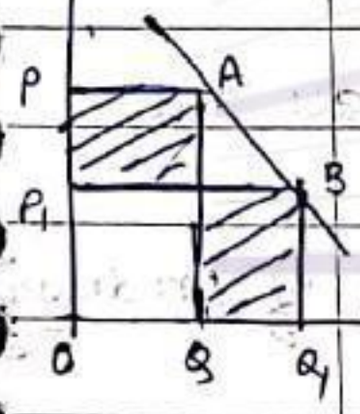
$Ep^d = 1.$

II. If we change the price expenditure varies inversely with price.

$Ep^d > 1.$

III. If we change the price, expenditure changes in same direction

$Ep^d < 1.$



P	Q	Ex	
4	1	4	$Ep^d = 1$
1	4	4	

$OP \times OQ = OPAQ.$ = (Expenditure)

$OP_1 \times OQ_1 = OP_1BQ$ "

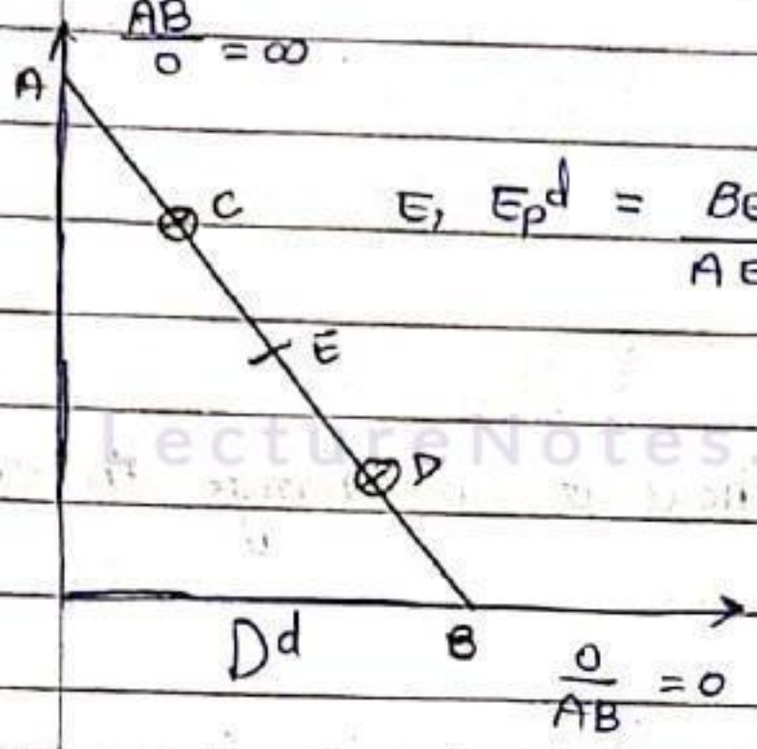
P	Q	Ex	
4	1	4	$Ep^d < 1.$
1	2	2	

P	Q	Ex	
4	1	4	$Ep^d > 1$
1	5	5	

__/__/____

* REVENUE MID-POINT METHOD

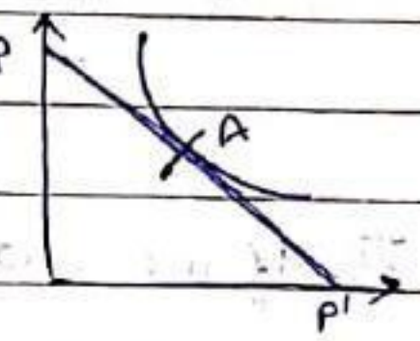
23 JULY '19



E, $E_p^d = \frac{BE}{AE} = 1$

$C = \frac{CA}{CB} > 1$

$D = \frac{DB}{AD} < 1.$



* REVENUE

Relation b/w price and quantity.

Demand curve is known as revenue curve & vice-versa

Total revenue : The amt. collected by selling all the products in market known as total revenue.

T.R. = P X Q [Revenue from side of producer

Average revenue : Per unit revenue / Amt. collected by selling one unit in market.

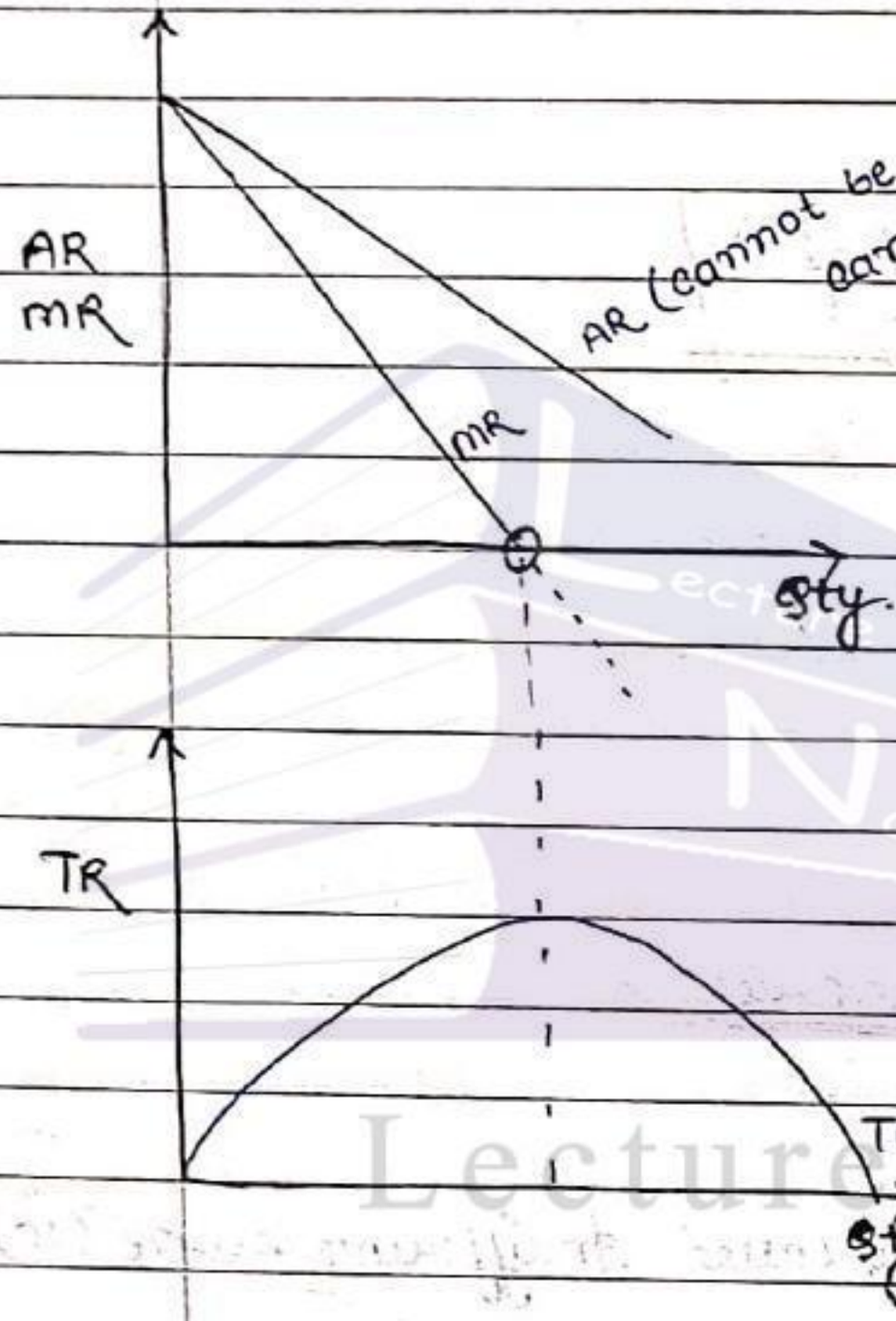
Average revenue = $\frac{TR}{Q}$. [Price].

Marginal revenue : Addition to the total revenue by selling one more unit of the product.

$MR = \frac{\Delta TR}{\Delta Q} = TR_n - TR_{n-1}$

__/__/__

Q	TR	MR
1	20	20
2	28	8
3	36	8
4	36	0
5	32	-4



1. TR increases → AR diminishes → MR decreases. (Both are positive)

2. When TR is maximum, AR diminishes, MR = 0.

3. When ↑R starts diminishing, AR diminishing but +ve, MR is diminishing & negative.

* ELASTICITY of D^d and REVENUE

$$Ep^d = \frac{AR}{AR - MR}$$

Let $Ep^d = e$ $AR = A$ & $MR = m$.

$$\Rightarrow e(A - m) = A$$

$$eA - em = A$$

__/__/____

$$eA - A = em$$

$$A(e-1) = em$$

$$A = \frac{em}{e-1}$$

$$\Rightarrow \boxed{AR = \frac{Ep^d \cdot mR}{Ep^d - 1}}$$

Also, $M = A\left(\frac{e-1}{e}\right)$

$$\Rightarrow \boxed{mR = AR\left(\frac{Ep^d - 1}{Ep^d}\right)}$$

P	Q	MR
10	4	
20	3	

$M = A\left(\frac{e-1}{e}\right)$

$e = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$ A = price

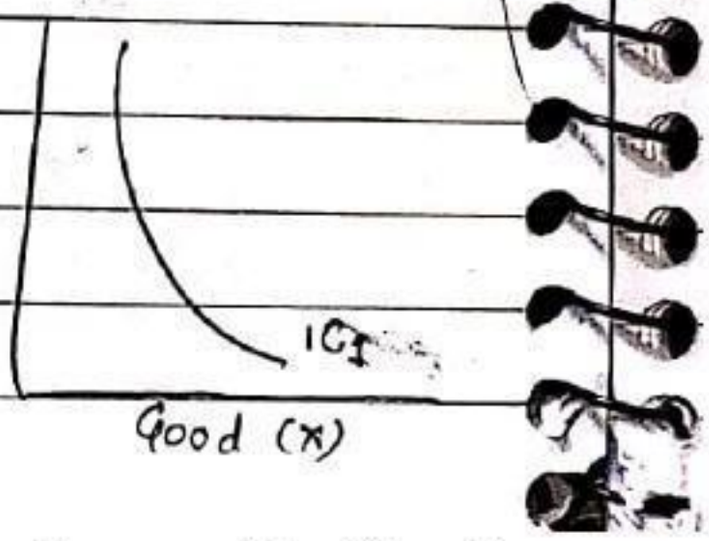
Ordinal approach is also called Indifference curve (IC) analysis.

"J.R. Hicks"

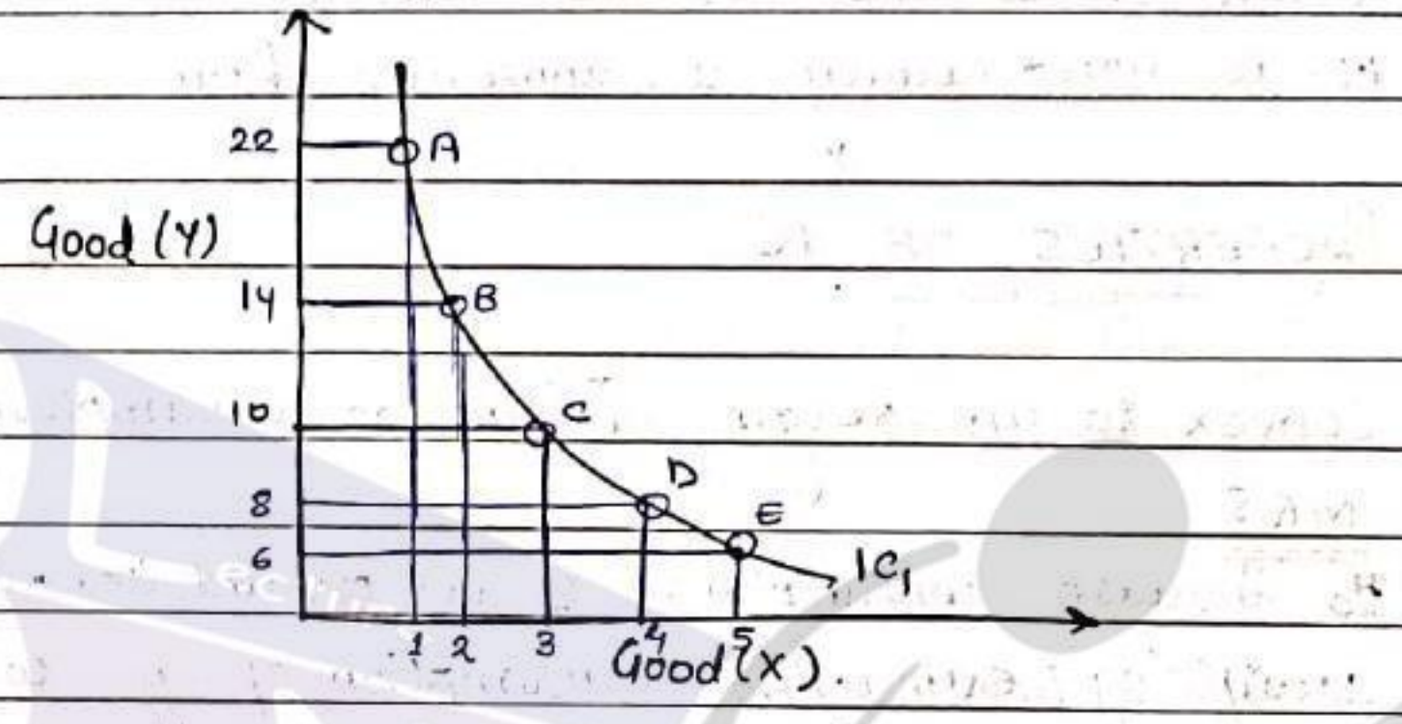
INDIFFERENCE CURVE (IC)

Indifference curve represents combination of 2 goods all consumed by a consumer which give him same level of satisfaction.

IC cannot be zero.

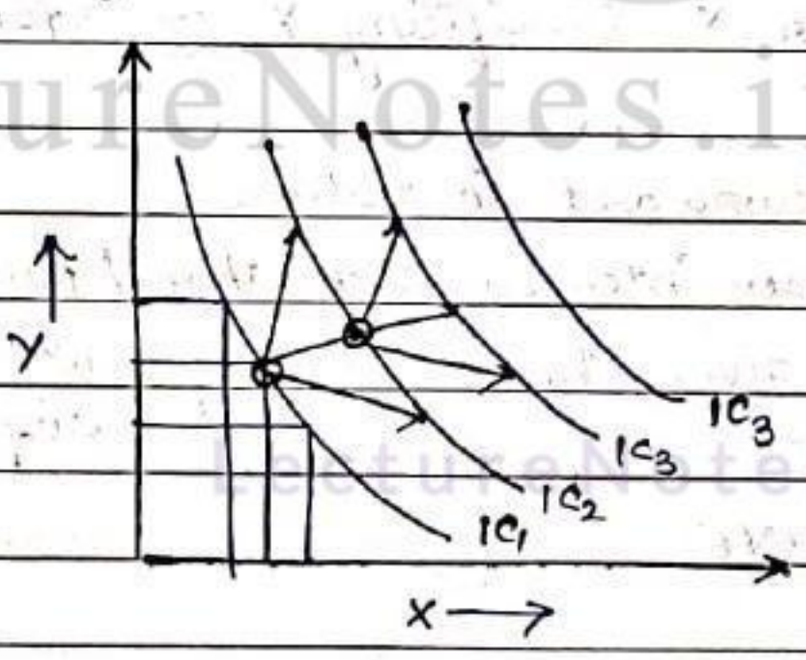


Combination	Good (X)	Good (Y)
A	1	22
B	2	14
C	3	10
D	4	8
E	5	6



Indifference map

A complete description of consumer's taste & preference is presented by indifference map.



* PROPERTIES OF INDIFFERENCE CURVE. 25 JULY '19

__/__/____

* ASSUMPTIONS OF IC

25 JULY '19

1. Indifference curve is convex to origin due to diminishing marginal rate of substitution
2. Application of transitive theory.
3. Consumer is rational in nature.
4. ~~It is~~ non-satiaty is applicable here.

* PROPERTIES OF IC.

1. Convex to the origin. [Same as assumption 1]
   - MRS

   To increase consumption of one product (x), the consumer is sacrifising / exchanging consumption of y. to get equal level of satisfaction is known as marginal rate of substit-ution (MRS)

   $$MRS_{xy} = \frac{-\Delta y}{\Delta x} = \text{slope of IC}$$

   for x sacrificing Y → X for Y.

2. Slope is downward in nature.
3. Two IC never intersect each other. / parallel to each other.
4. Higher IC gives higher level of satisfaction than the lower IC

* BUDGET LINE

Budget line represents ~~income & price of Goods X & Y.~~ set of combination of 2 goods that can be purchased with the given income & prices of 2 goods.

Slope of budget line = $\frac{P(X)}{P(Y)}$

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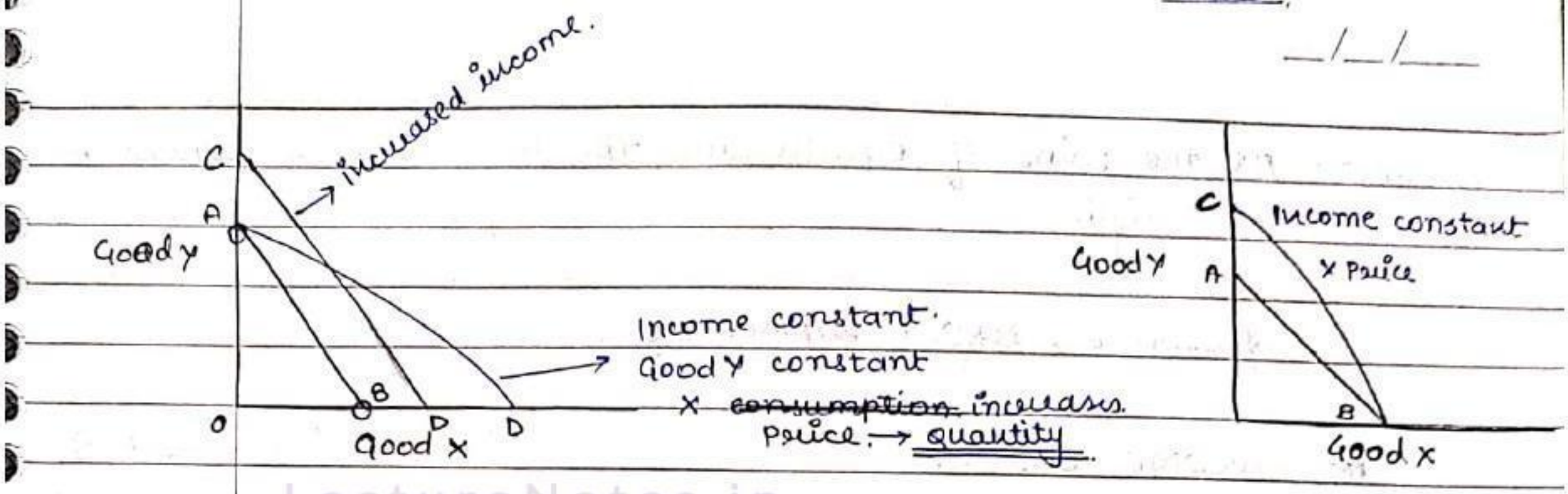
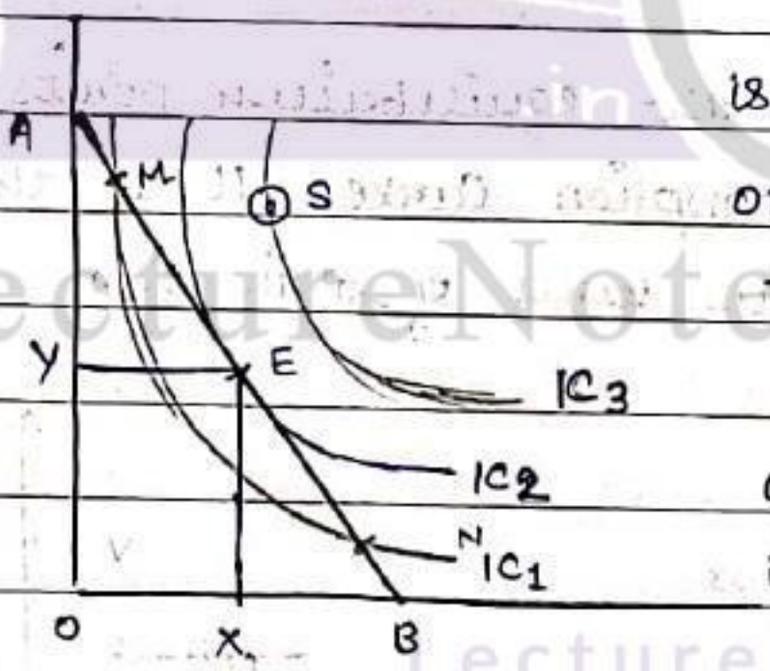


* If there is change in income, no change in price of goods, budget line shifts parallely with previous one.

* If there is change in price of x, budget line will shift AB → AD.
* If there is change in price of Y, budget line will shift AB → BC

→ CONSUMER'S EQUILIBRIUM.

→ When IC is tangent to budget line then it is consumer's equilibrium.



Consumer's equilibrium is on E as it is higher on (IC_2) & gives more satisfaction.

while S is not because it is not on budget line.

Necessary condition for consumer's equilibrium: (Not sufficient)

$$MRS_{xy} = \frac{P_x}{P_y}$$

If $MRS_{xy} > \frac{P_x}{P_y}$, substitute x for y until they are equal.

Similarly $MRS_{xy} < \frac{P_x}{P_y}$ substitute y for x until equal.

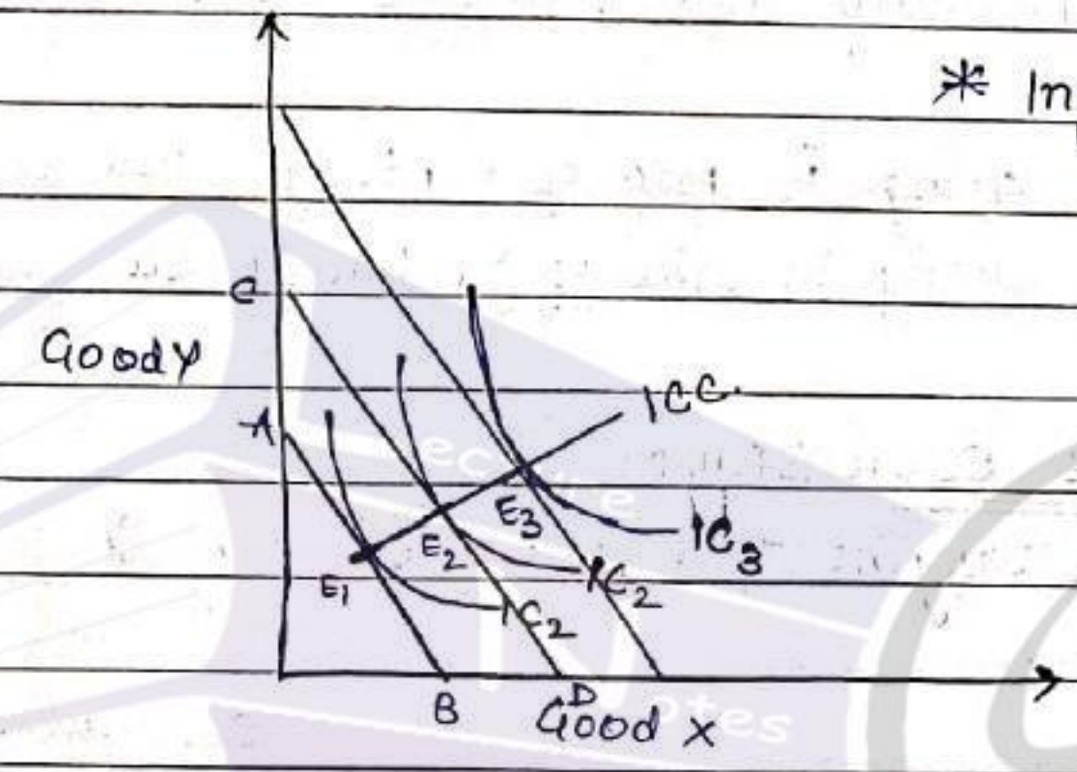
Sufficient condn: At the point of equilibrium the IC curve is convex to the origin

If concave, MRS ↑ inplace of ↓.

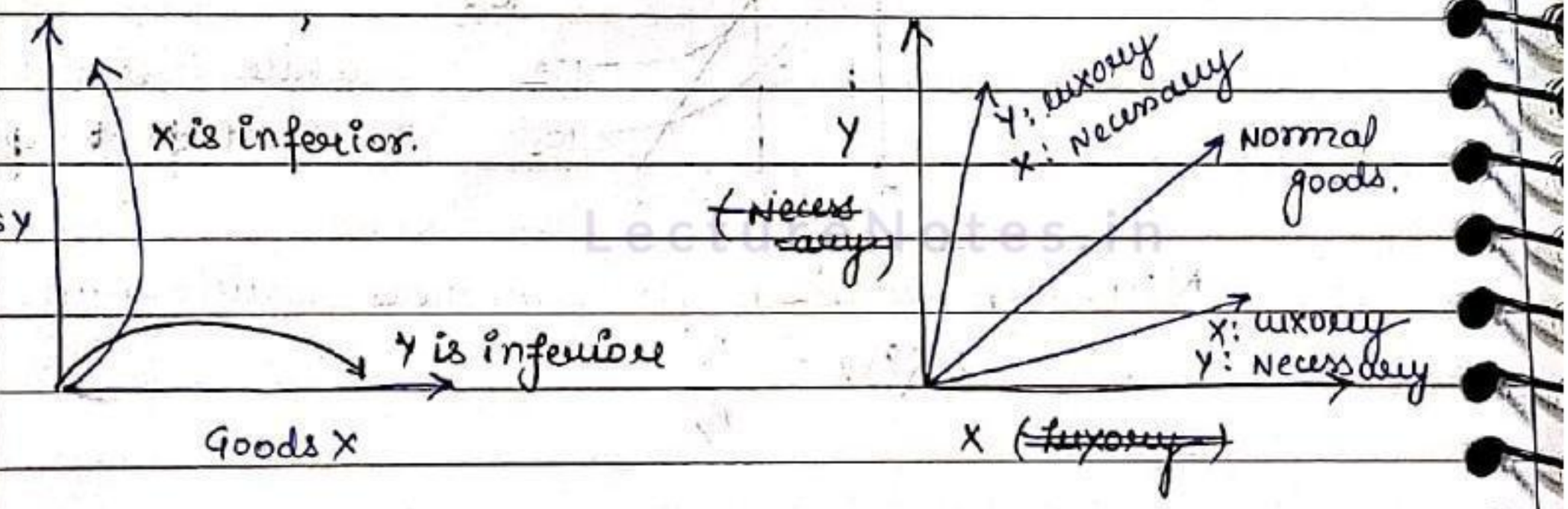
* INCOME EFFECT

29 JULY'19

The change in consumers purchases of goods as a result of change in his money income.

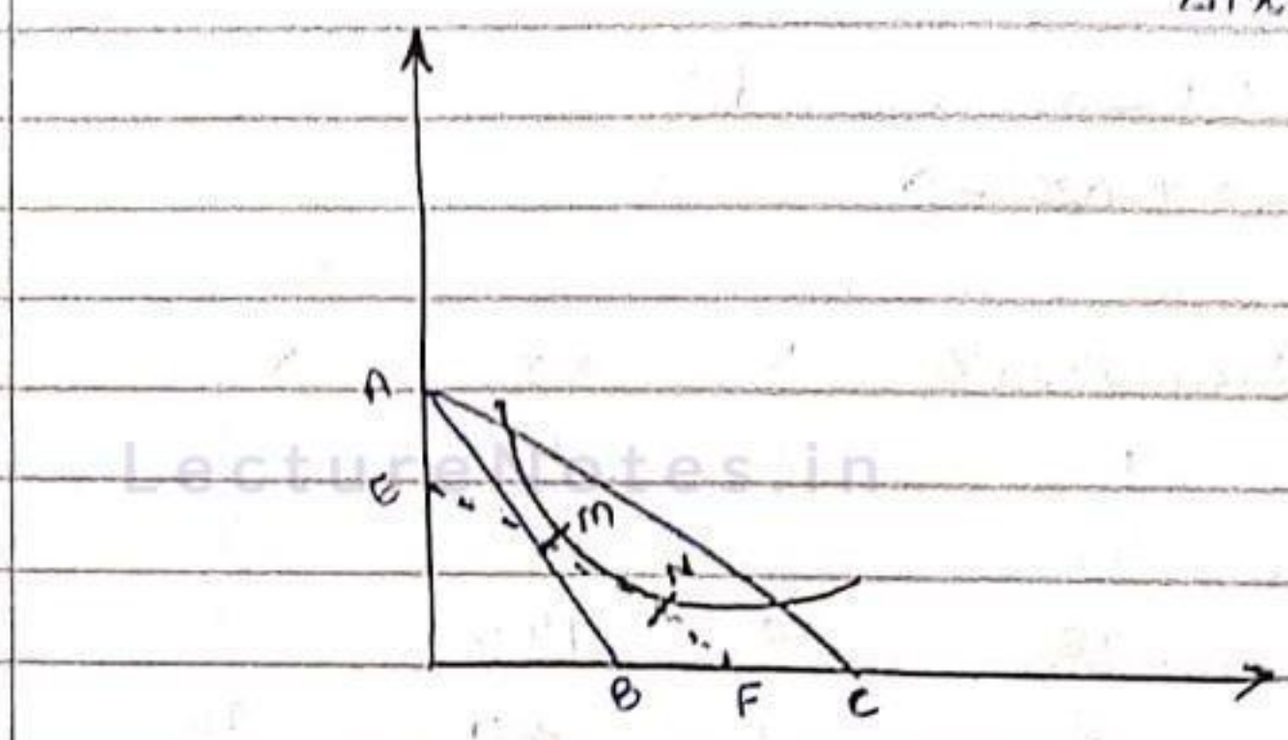


If we join all the equilibrium points, we are getting ICC or Income Consumption Curve. It is the locus of equilibrium points at various levels of income of consumer.



* SUBSTITUTION EFFECT

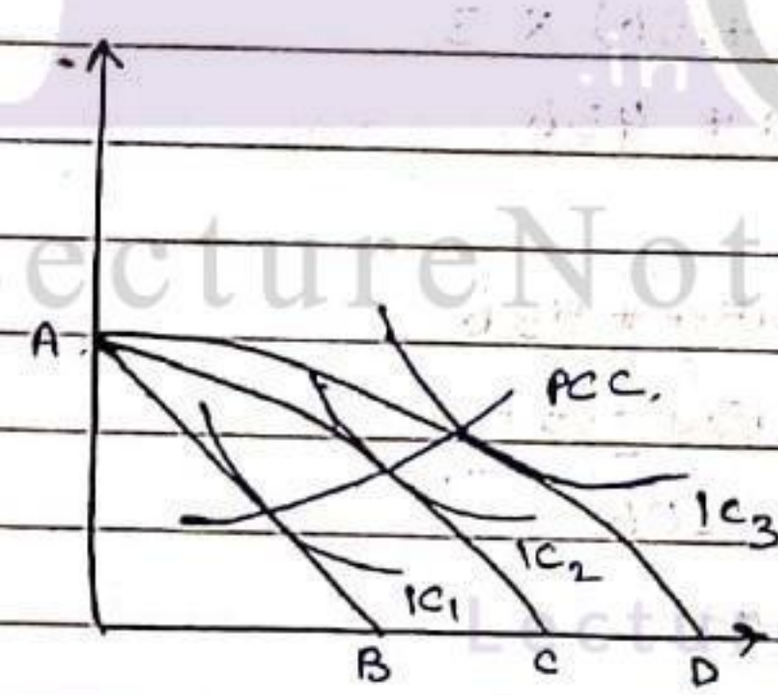
It represents change in qty. purchase of a product as a result of a change in its relative price alone keeping



EF represents decrease in income.

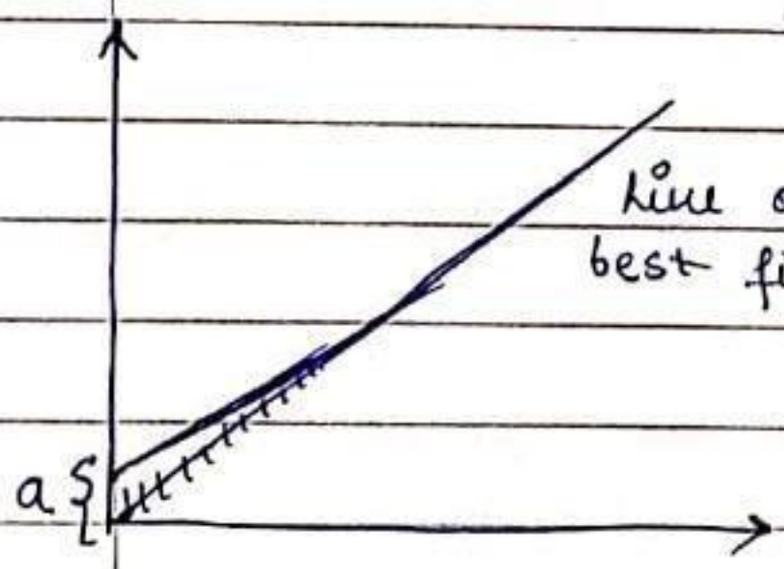
* PRICE EFFECT.

Price effect represents the way consumer purchase of product (x) changes, when its price changes., given his money income, preference, taste.



Effect of market price on consumer's demand.

* REGRESSION.



$y = a + bx$

↓ ↳ slope of curve.

y intercept

~~$\Sigma Y = Na + b\Sigma x$~~

~~$\Sigma x = a\Sigma x + bx$.~~

Trend : $a+b(1)$
$a+b(2)$
⋮

* LEAST SQUARE METHOD.

$\Sigma Y = Na + b\Sigma x$ ——— (I).

$\Sigma xy = a\Sigma x + b\Sigma x^2$ ——— (II)

$N = 5$

Q. Year (X)	Sale (Rs) (Y)	x	xy	x^2
2001	45	1	45	1
2002	52	2	104	4
2003	48	3	144	9
2004	55	4	220	16
2005	60	5	300	25
	$\Sigma Y = 260$	$\Sigma x = 15$	$\Sigma = 813$	$\Sigma = 55$

By eqn (I)

$260 = 5a + 15b$ ——— (i)

eqn (II) $813 = 15a + 55b$ ——— (ii)

$(260 = 5a + 15b) \times 3$.

$\Rightarrow 780 = 15a + 45b$.

$\Rightarrow 813 = 15a + 55b$
$780 = 15a + 45b$
$33 = 10b$.

$\Rightarrow b = 3.3$

$813 = 15x(3.3) + 15a + 55(3.3)$

$\Rightarrow 813 - 181.5 = 15a$

$a = 42.1$

By $y = a + bx$

$\Rightarrow y = 42.1 + 3.3 \times 9$.

$y = 71.8$

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30 JULY '19

*

P(x)	A^d(Y)	X	XY	X^2
10	58	10	580	100
12	52	12	624	144
9	65	9	585	81
11	60	11	660	121
14	55	14	770	196
15	57	15	855	225
	347	71	4074	867

$(347 = 6.a + b.71.) \times 71$

$(4074 = a.71 + b.867) \times 6.$

$\Rightarrow \quad 24637 = 426a + 5041b$

$24444 = 426a + 5202b$

$193 = -161b$

$-1.198 = b$

$347 = 6a + 71(-1.198)$

$= 6a - 85.058$

$347 + 85.058 = 6a$

$a = 72.01$

$\Rightarrow \quad y = 72.01 - 1.19x$

If $x = 20$ what is y.

$y = 72.01 - 1.19(20)$

$= 48.21$

Deviation method

METHOD-2 * Price x, Dd y, $(x-\bar{x})$ x, $(y-\bar{y})$ y, xy, x^2

x	y	x	y	xy	x^2
2	4	-3.2	-4.2	13.44	10.24
3	5	-2.2	-3.2	7.04	4.84
5	7	-0.2	-1.2	0.24	0.04
7	10	1.8	1.8	3.24	3.24
9	15	3.8	6.8	25.84	14.44
				49.8	32.8

$\bar{X} = 5.2$ $\bar{Y} = 8.2$

$$b_{yx} = \frac{\Sigma xy}{\Sigma x^2}$$

$$= \frac{49.8}{32.8} = 1.518$$

$$(Y-\bar{Y}) = b_{yx}\cdot(x-\bar{x})$$

$$Y - 8.2 = 1.52\,(X - 5.2)$$

$$Y - 8.2 = 1.52X - 7.904$$

$$Y = -7.904 + 8.2 + 1.52X$$

$$Y = 0.296 + 1.52X$$

If Price = 12 what is Demand.

$$Y = 0.296 + 1.52 \times 12$$

$$Y = 18.536$$

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UNIT-3 TIME VALUE OF MONEY

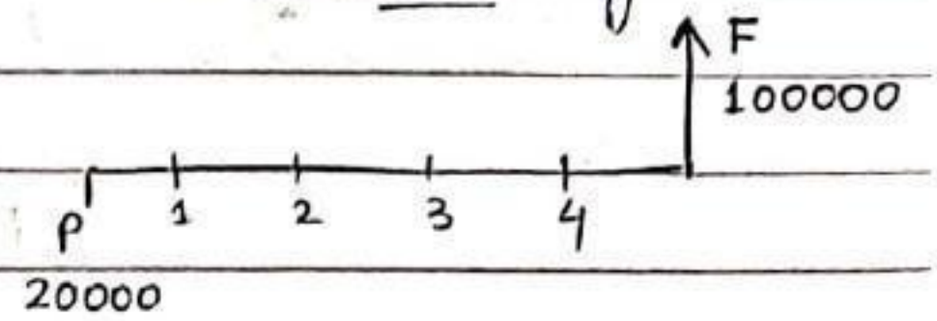
P: Present

F: future amount

i: Interest rate

n: Time

Cash flow diagram



1. → SINGLE PAYMENT COMPOUND AMT.

Find single future amount of the initial payment P with a given time prd. of ROI.

$$F = P(1+i)^n$$

Factor of single payment: P(F/P, i, n)
for future value

* A person is depositing amt. of P = 20000 in bank with 10% interest rate compounded annually for the time period of 18 yrs. Find maturity value after 18 yrs.

P = 20000

i = 0.10

n = 18

$F = 20000(1+0.1)^{18}$

$= 111198.3463$

2. → SINGLE PAYMENT PRESENT WORTH AMT.

Q. A person wants future sum of ₹1 lakh for education of his son after 10 yrs. from no. Find single pay. deposited at present so that he gets the desired amt with a ROI given by bank is 15%.

$$P = \frac{F}{(1+i)^n}$$

Compound-is future valu

$P(P/F, i, n)$

$100000(P/F, 0.15, 10yrs)$

$\Rightarrow \quad P = \frac{100000}{(1+0.15)^n}$

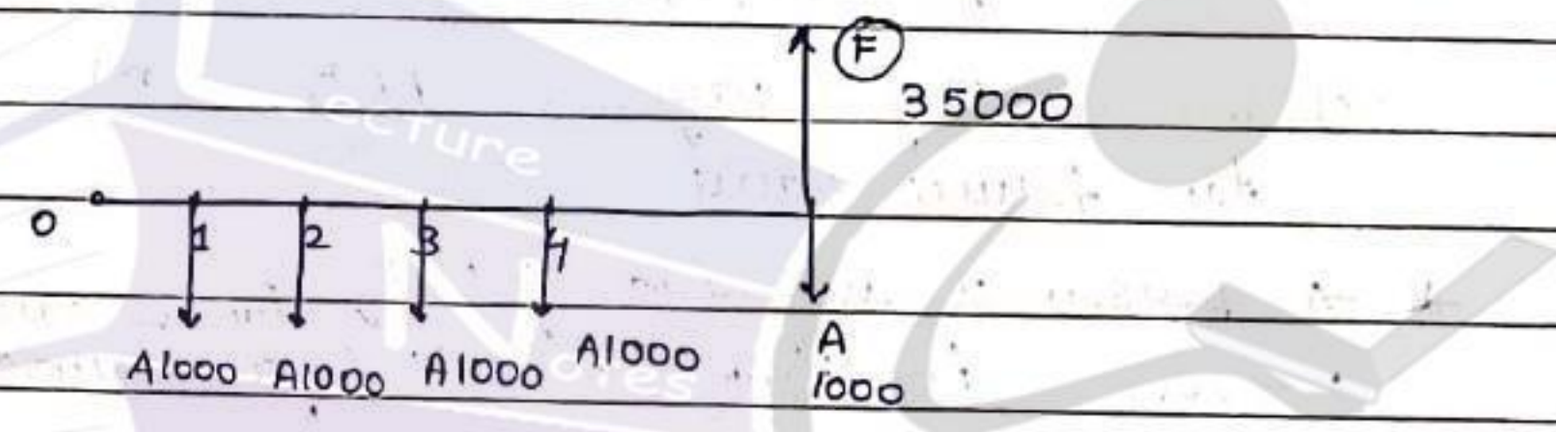
$\therefore P = ₹\ 24,718.47$

INTEREST RATE FORMULAS.

01/AUG/19

3. SINGLE EQUAL PAYMENT

a) Equal pay compound amt.



$$F = A\left\{\frac{(1+i)^n - 1}{i}\right\}$$

$F = (F/A, i, n)$ (factors)

where A is annual instalments.

Q. The objective is to find F of n equal payments which are made at the end of every interest period till the end of n^{th} year at an interest rate of i compounded at the end of every year.

Q. A person who is now 35 yrs old planning for his retirement. He plans to invest an equal sum of ₹10000 at the end of every year for next 25 yrs.

Bank gives him 10% ROI, find the maturity value when he is 60 yrs. old.

$A = 10000$ $i = 10\% = 0.1$ $n = 25$ yrs. $(60-35)$

$$\Rightarrow F = A\left\{\frac{(1+i)^n - 1}{i}\right\}$$

$$= 10000\left\{\frac{(1+0.1)^{25}-1}{0.1}\right\}$$

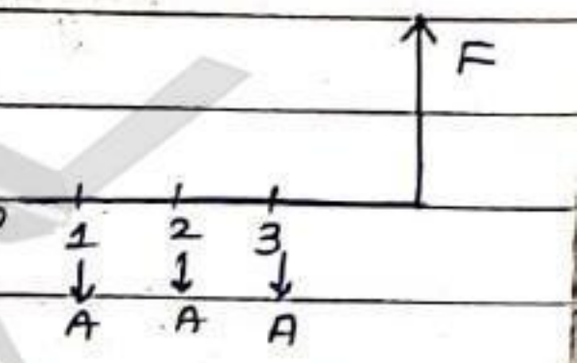
$$= 983470.5$$

b) Equal pay sinking fund.

Find A i.e. annual equivalent amount given F, i. & n (time period)

$$A = F\left\{\frac{i}{(1+i)^n - 1}\right\}$$

$$A = F\{F/A, i, n\}$$



Q. A company has to replace a present facility after 15 yrs. after an outlay of ₹5 lakhs. It plans to deposit an equal amt. at the end of every year at an ROI of 9%. compounded annually. Find the equivalent amt. that must be deposited at the end of every interest prd.

$$A = F\left\{\frac{i}{(1+i)^n - 1}\right\}$$

$F = 5,00,000$ $i = 0.09$ $n = 15$.

$$= 5,00,000\left\{\frac{0.09}{0.1809}\right\}$$

$$= 5,00,000\left\{\frac{0.09}{2.642}\right\}$$

$= ₹\ 17,0294$

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iii) Equal pay present worth

$$P = A\,(P/A, i, n)$$

In this case we have to find out present worth given equal amt. interest & time prd.

$$P = A\,\frac{(1+i)^n - 1}{i\,(1+i)^n}$$

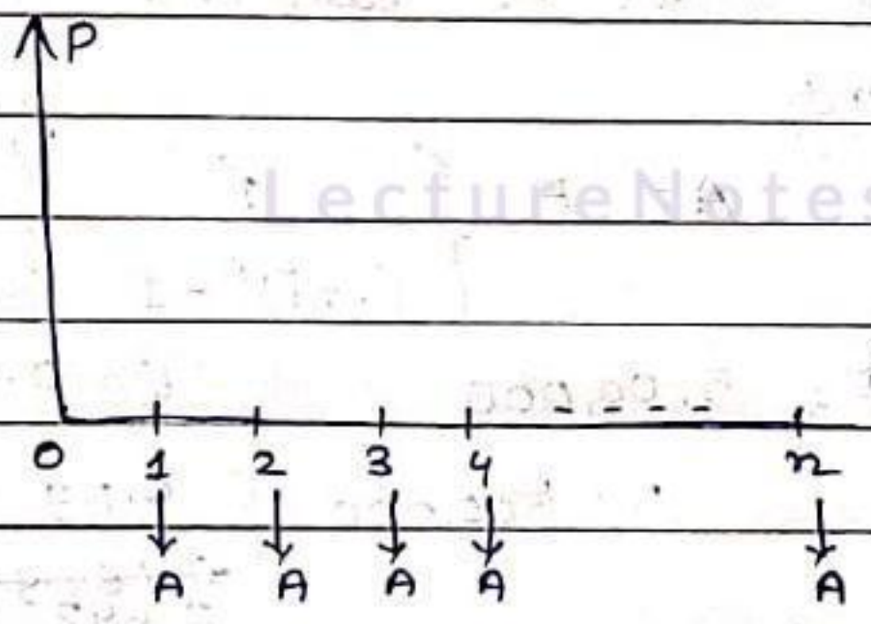
Q. A company wants to set up reserve of amt. which will help the company to have an equal equivalent amt. of ₹ 10 lakhs for next 20 yrs. towards its employees welfare purpose. The reserve is assume to grow @ 15% compounded annually. Find the single payment must be made now as the reserve amt

$A = 10,00,000 \qquad i = 0.15 \qquad n = 20.$

$$P = 1000000 \cdot \frac{(1+0.15)^{20} - 1}{0.15\,(1+0.15)^2}$$

$$= 1000000 \times \frac{15.366}{2.4549}$$

$$= ₹\ 6259331$$



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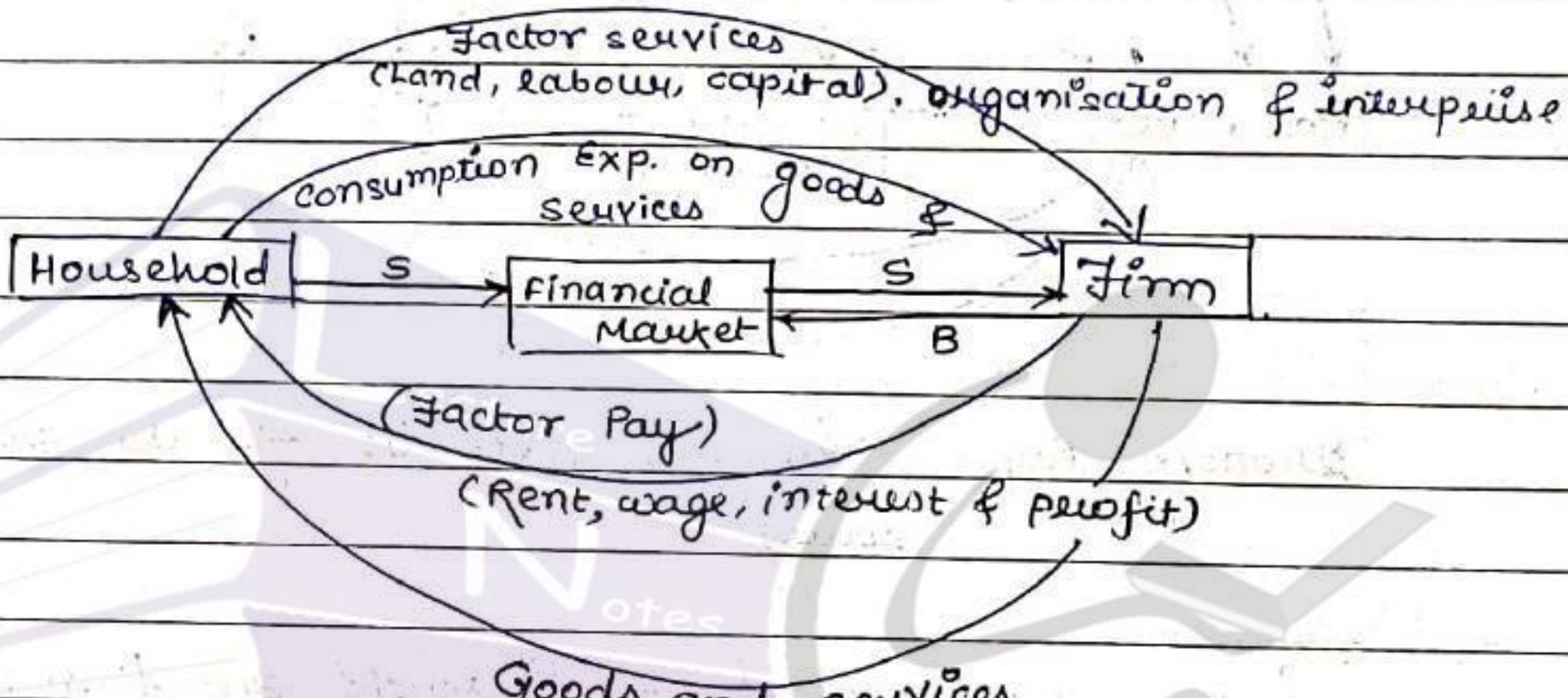
05/AUG/19

1. Stock : Availability of product (static)
2. Flow : Variable keeps on changing (dynamic)

PHASES OF INCOME

1> Production 2> Distribution 3> Expenditure

* ## CIRCULAR FLOW IN 2 SECTOR.



Financial market : Share market, banks (Financial institution)

S: saving B: Borrowing

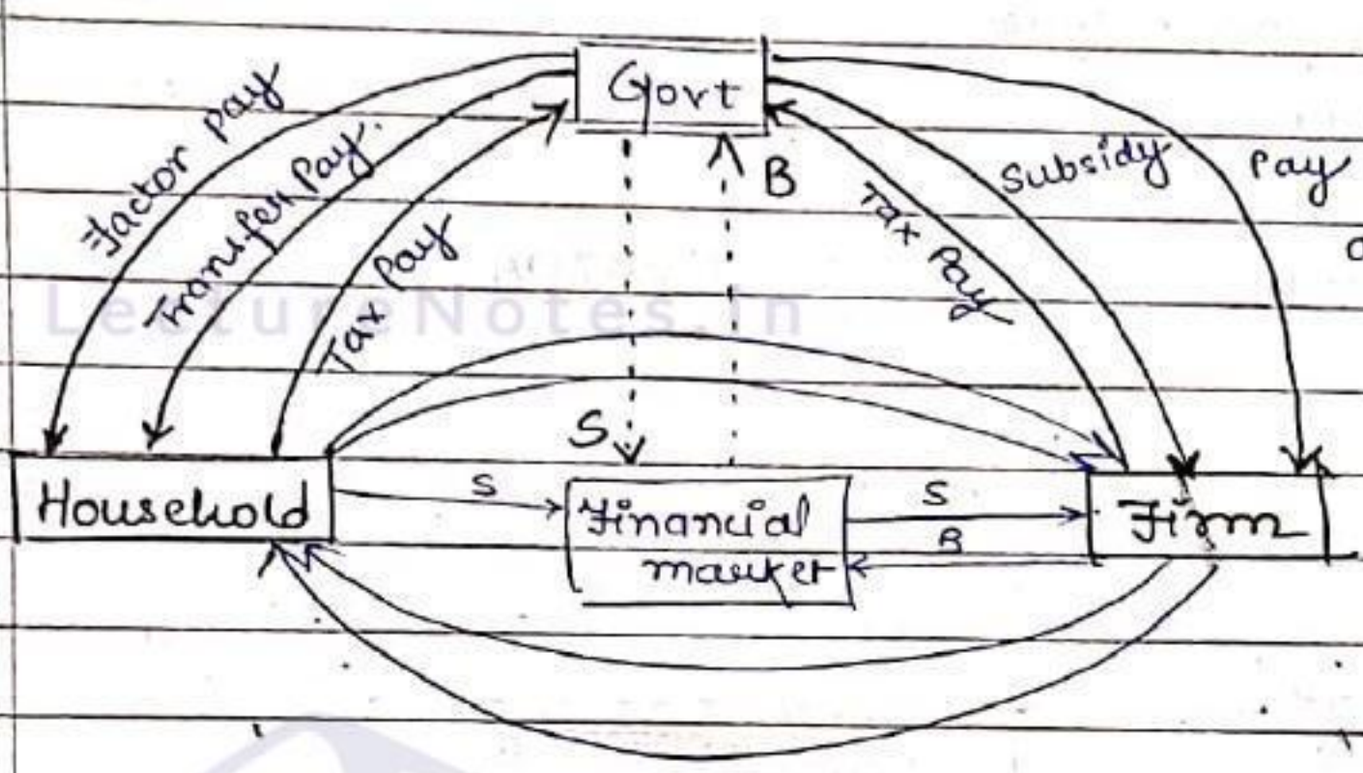
income ≠ expenditure

In case of two sector model without financial market,
total production = total consumption.
Factor payment = Factor income.
Consumption expenditure = Factor income
Real flow = money flow.

With the introduction of finance market which is institution such as banks, insurance company etc. ~~which transact in~~ Money flow from household to market & financial market to firm in form of savings. Financial market also borrow from

firm or production house.

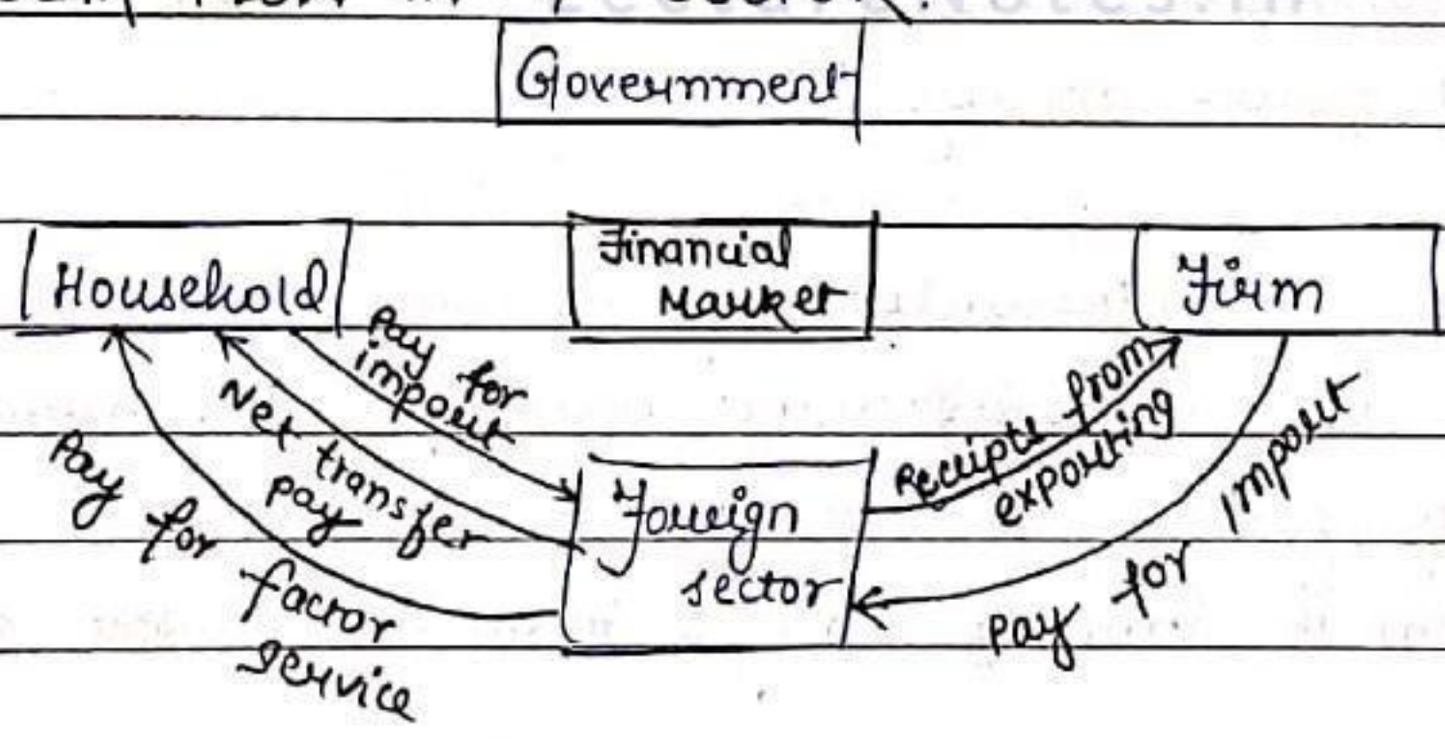
* CIRCULAR ~~SECTOR~~ FLOW IN 3 SECTOR



Transfer Pay : Subsidy, govt. aids for the welfare of society.

- Govt. collects taxes from household and firms.
- Govt. makes transfer payments to the households & provides subsidy to the firm.
- Govt. makes payment for purchase of goods & services from the firm.
- Govt. saves & borrows money with the help of financial market.

* CIRCULAR FLOW IN 4 SECTOR.



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With the intro of foreign sector income will flow from firm to foreign sector in terms of payment &
And income flow from foreign sector to firm emerge from export.
Income flow from household to form foreign sector in the form of payment for imports & from foreign sector it is it net transfer payment & payment for factor service.

Significance for circular flow
i) It helps us to understand the mutual interdependence among the sectors.
ii) It shows the equilibrium position of economy.
iii) It helps in identifying various types of leakages & injections in the economy.

* Demand = -ve.
Supply = +ve.

06/AUG/19

Q. $Q^d = 1000 - 200P$.

$P_x = ₹3$

Compute E_p^d.

$Q^d = 1000 - (200 \times 3)$

$= 400$.

200 : coefficient / slop of curve

$= \frac{\Delta Q}{\Delta P}$.

$E_p^d = \left| \frac{\Delta Q}{\Delta P} \times \frac{3}{400} \right|$

$= \left| \frac{200 \times 3}{400} \right|$.

$= \frac{3}{2} > 1$. $= 1.5\% \Delta D^d$.

Relatively elastic

__/__/____

(P x Q)

Q. If expenditure ~~of P & Q~~ is 200. What happens to elasticity of demand when price decreases.

With change in price, expenditure remain constant, unitary elastic $Ep^d = 1$

Q. The Ep^d of a product is -2.5. If price of product is reduced by 30%, how much % increase in Q^d of the product sold in the market do you expect?

[omit negative sign].

$$Epd = \frac{\% \text{ change in } Dd}{\% \text{ change in price.}}$$

$$2.5 = \frac{x}{30}$$

$$x(Dd) = 0.75 \text{ or } 75\%.$$

Q. A study in USA indicates that price elasticity of Dd for cigarettes is 0.4. If a pack of cigaratte currently cost $2 & govt. wants to reduce smoking by 20%. By how much should it increase the price?

$$0.4 = \frac{20}{\%.\Delta P.}$$

$$\%.\Delta P = \frac{20}{0.4}$$

$$\Delta P. = 50\%$$

Increased price = $2 + $1

= $3

Q. A company sells its 1 kg packet in ₹50. Its sell have been 6000 units per month. Recently its competitor decreases the price of its same std. Washing powder from ₹70 to ₹60

__/__/____

So the sell of the first one decreases by 1500 units per month. Calculate the elasticity b/w the products.

$$E_c^d = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

$$= \frac{\% \Delta Q_x}{\% \Delta P_y}$$

$\Delta P = 70 - 60$

$= 10$

$P_y = 60$

$\frac{80-50}{80} \times \frac{1000}{10}$ $= \frac{6000 - 1500}{6000} \times 100$

$\frac{10}{80} \times 1000$ $\frac{10}{60} \times 100$

$= \frac{30 \times 100}{80}$ $= \frac{4500}{6000} \times 100$

$\frac{10 \times 100}{80}$ $\frac{100}{6}$

$= \frac{30 \times 100}{10 \times 100}$ $= \frac{4500}{6} \cdot \frac{6}{100}$

$= 3$ $E_c^d = 4.5\%$

1% change in price of one product, 4.5% change in other product price.

Q. If consumer's daily income increases from 900 to 450, his purchase of good x increases from 25 units per day to 40 units. Compute elasticity of Dd.

$$E_y^d = \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q}$$

$$= \frac{15}{150} \times \frac{300}{25}$$

$$= \frac{30}{25} = 1.2$$

__/__/____

seller.

Q. Suppose a ~~sattort~~ of a textile industry wants to lower the price of its cloth from 150/m to 142.5/m. If its present sells are 2000m/month. & further it is estimated that its elasticity of D^d of product is 0.7.

→ Whether or not total revenue will increase as a result of his decision to lower the price?

→ Calculate the exact magnitude of its new total revenue.

$$0.7 = \frac{\Delta Q}{150 - 142.5} \times \frac{142.5}{2000.}$$

$$= \frac{\Delta Q}{7.5} \times \frac{142.5}{2000.}$$

$$0.7 = \frac{\Delta Q}{7.5} \times 0.07125.$$

$$\frac{5.25}{0.07125} = \Delta Q \times 0.07125$$

$$\Rightarrow \Delta Q = 73.68$$

$$= 70$$ (∆ taken P = 150)

New quantity : 2070

New Price : 142.5.

Total revenue = P x Q

= 2070 x 142.5

= 2,94,975

Old revenue = 2000 x 150.

= 3,00,000

Total revenue diminished.

1.5455.

__/__/__

13/8/19

UNIFORM GRADIENT SERIES

Gradient starts from second year.

Gradient

(1000) 1000 + 600 1000 + 600 + 600.

1000 1600 2200

* Equal ~~sevvi~~ series → future value.

Increasing gradient series :- From an initial amt. value increases.

Diminishing gradient series :- From a huge amt. value decreases.

$$A = A_1 + G\left\{\frac{(1+i)^n - in - 1}{i(1+i)^n - i}\right\}$$

$$f = A \cdot \left\{\frac{(1+i)^n - 1}{i}\right\}$$

Q. A person plans for his future life. He is depositing amt. of 4000 at the end of first year. Thereafter he wishes to deposit increase of ₹500 for next 10 yrs. The bank is giving ROI 15% compounded annually. Find the maturity value at the end of 10th year.

$A_1 = 4000.$ $G = 500$ $i = 0.15$ $n = 10.$

$$A = 4000 + 500\left\{\frac{(1+0.15)^{10} - 0.15\times10 - 1}{0.15(0.15+1)^2 - 0.15}\right\}.$$

$= ₹5691.6.$

__/__/____

$$F = 5691.6 \left\{ \frac{(1+0.15)^{10}-1}{0.15} \right\}$$

$$= 1,15,560$$

$$A = A_1 - G \left\{ \frac{(1+i)^n - i.n - 1}{i.(1+i)^n - i} \right\}$$

for decreasing series.

Q. Person is depositing amt. 8500 at the end of first. Then he wishes to decrease amt. of deposit by ₹500. Find the maturity value at the end of 10th year if bank is giving ROI 15% compounded annually.

$A_1 = 8500 \quad G = 500 \quad i = 0.15 \quad n = 10.$

$$A = 8500 - 500 \left\{ \frac{1.15^{10} - 0.15 \times 10 - 1}{0.15(0.15)^{10} - 1} \right\}$$

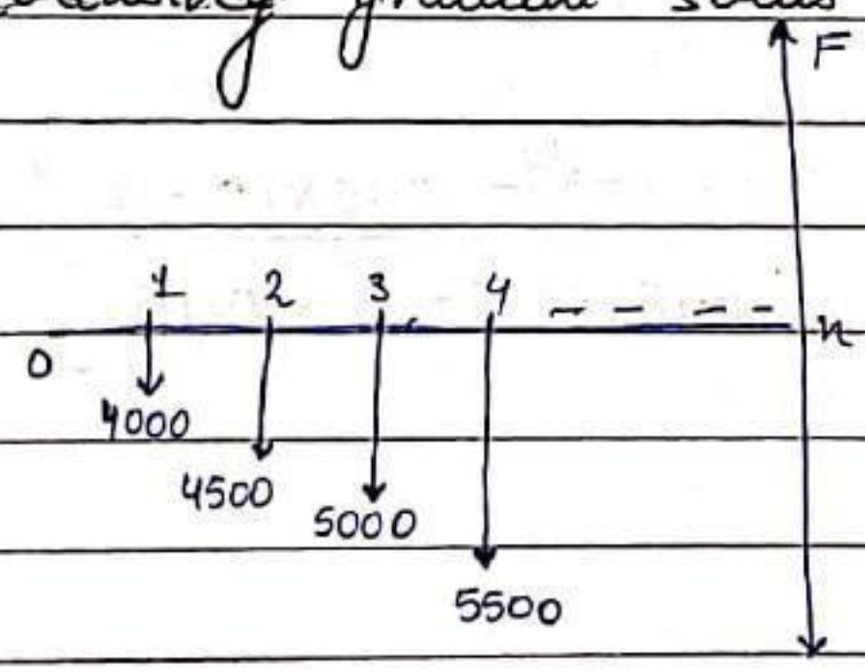
$$= ₹6808.4.$$

$$f = A \left\{ \frac{(1+i)^n - 1}{i} \right\}$$

$$= ₹\ 138237.75$$

Cash flow diagrams.

i) Increasing gradient series



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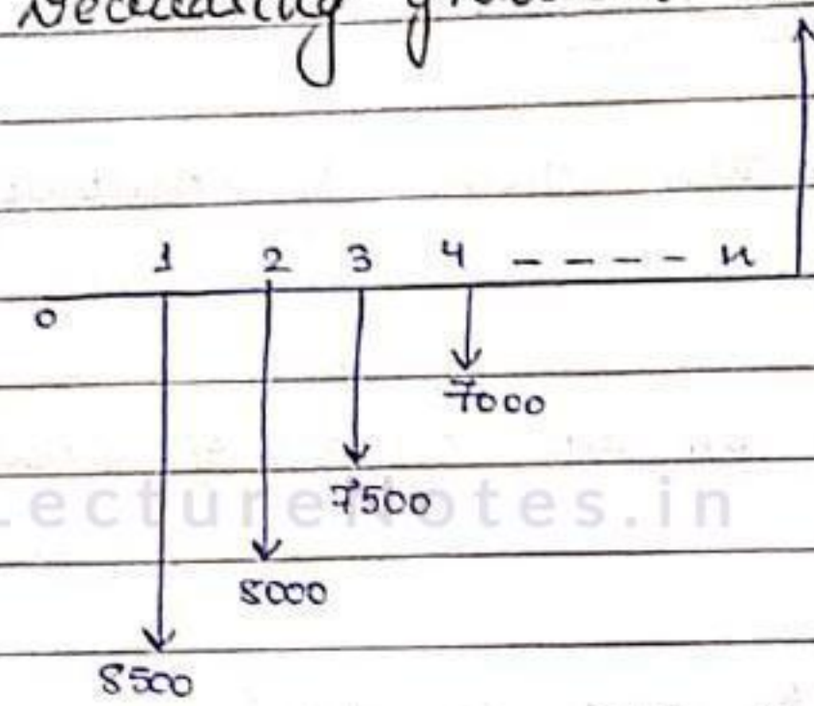
iii) Decreasing gradient series



EFFECTIVE RATE OF INTEREST.

C: interest period. n: year.

Quarterly: 4

Half yearly: 2

$$R = \left(1 + \frac{i}{c}\right)^{c} - 1.$$

Q. A person is depositing amt. of ₹5000 in bank. The interest rate is 12% compounding quarterly. What is the maturity value after 10 yrs.

$P = 5000 \quad i = 0.12 \quad n = 10 \quad c = 4$

$$R = \left(1 + \frac{0.12}{4}\right)^{4} - 1$$

$= 12.55.$

$f = P(1+R)^{n}$

$= 5000\left(1 + 0.1225\right)^{10}$

$= ₹16,309.93$

__/__/____

17.08.19

* NATIONAL INCOME *

1. Direct tax : directly on the income of consumer
   Income tax.

2. Indirect tax : Indirectly on the income of consumer.
   GST, sales tax, tariff.

3. Subsidy : Contribution by govt. to public.

4. Net indirect Tax (Tax - Subsidy).
   ↳ always +ve

5. Factor income from abroad (FIFA)

6. factor income to abroad (FITA) : Paying NRI. is FITA

7. Net factor income from abroad (NFIA) FIFA - FITA

8. Depreciation :- slowly decrease in (income).

Difference

9. FC
   factor cost :- The amount paid to (for) factors.
   (labour, land, capital, organisation)

10. MP
    Market Price : The price of goods that we sell in market.

Domestic : Within the territory of country.

National : Outside the boundary of country.

GDP :- Total amt. of goods and services produced in an economy within one year. [within the boundary of a country irrespective of residents/non-residents of the country.]

GDI = GDP

Net National Product. NDP: Net domestic product.

$GDP_{mp} = GDP_{FC} + NIT$

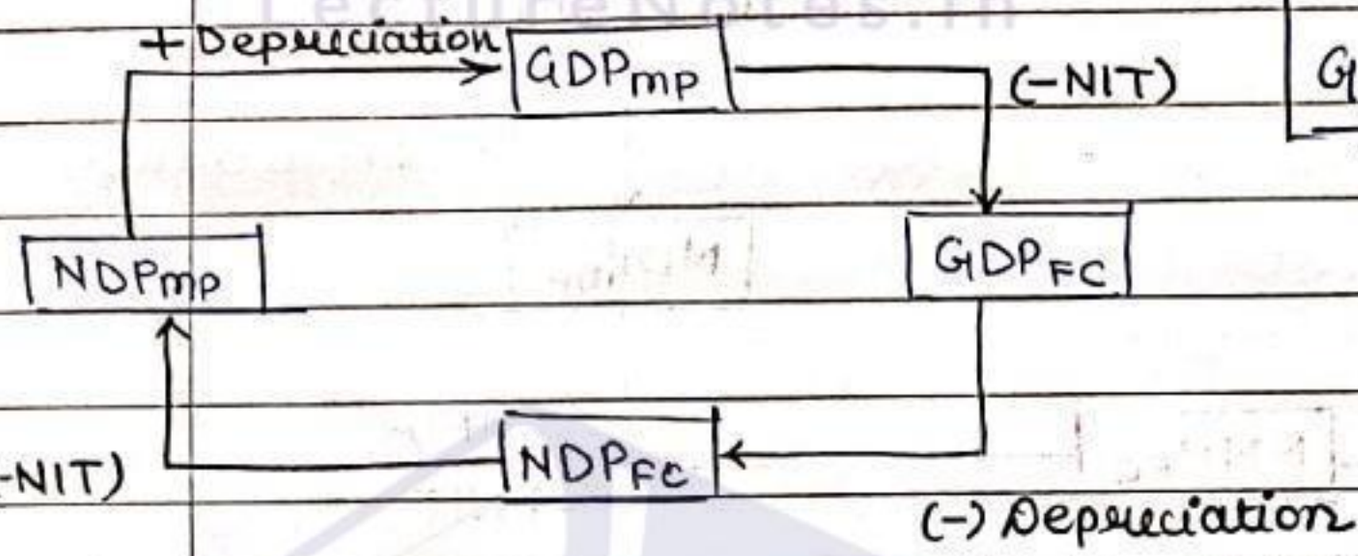
$GDP_{FC} = GDP_{mp} - NIT$

$GDP_{FC} - Depreciation = NDP_{FC}$

★ Factor cost FC = Market price - Net indirect tax

Net = Gross − Depreciation

Gross = Net + Depreciation



→ Gross National Product (GNP)
[Indians living in abroad, their income added with GDP]

- $GNP_{MP} = GDP_{MP} + NFIA$
- $GNP_{FC} = GDP_{FC} + NFIA$.
- $GNP_{FC} = \{GNP_{mp} - NIT\} + NFIA$.
- $NNP = GNP - Depreciation$
- $NNP_{FC} = GNP_{MP} - NIT - Depreciation$.
- $GNP_{mp} = NNP_{FC} + NIT + Depreciation$.

NFIA = Export - Import
[+ve]

Differentiate b/w National & Domestic Income.

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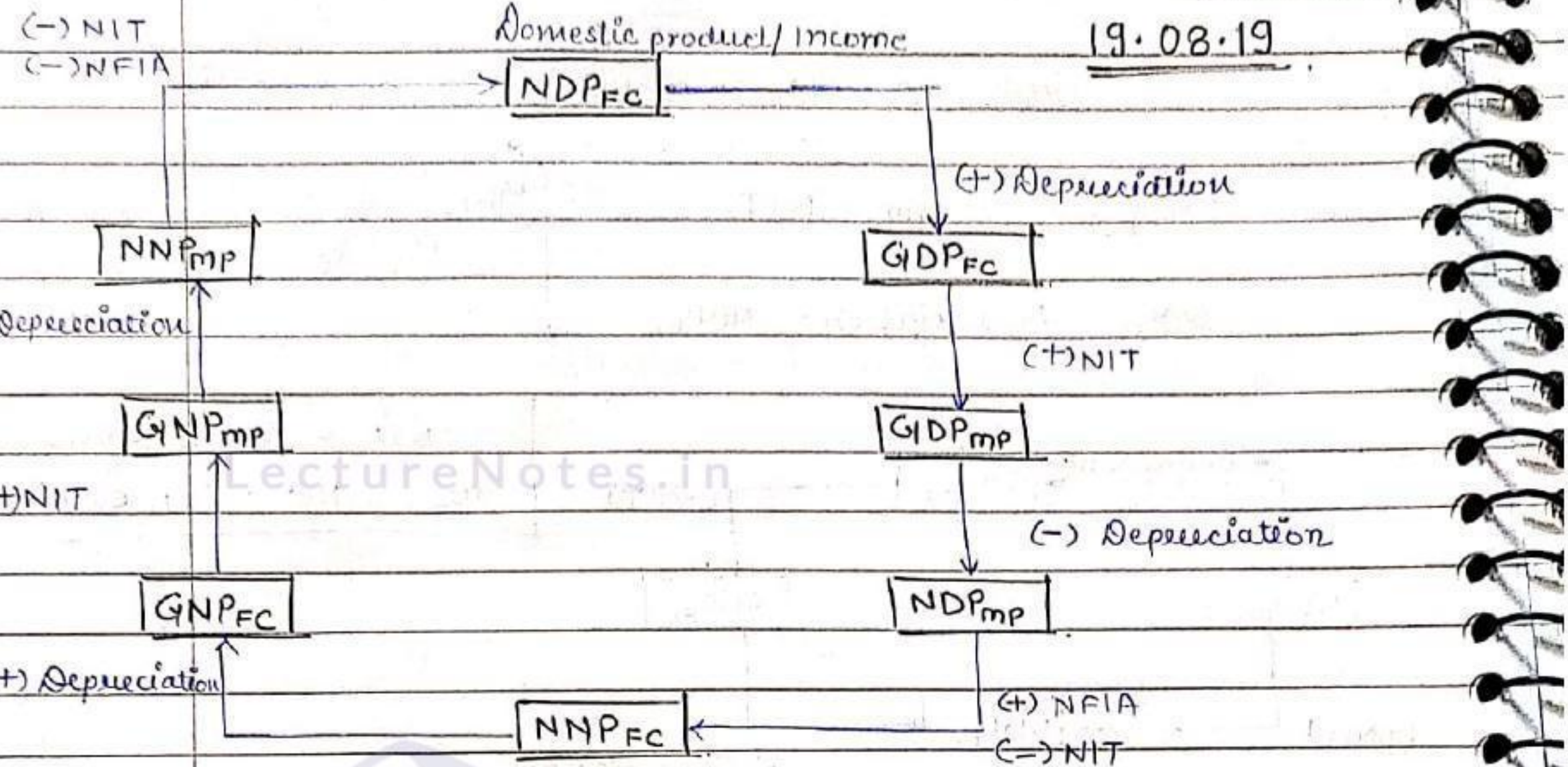
19.08.19



1. T - S = NIT
2. NFIA = (X - M)
3. Gross - Depreciation = Net
4. NP - NIT = N = FC
5. National - NFIA = Domestic.

Q. Particulars.

GNP_{MP}	₹6000	
Subsidy	₹200	
Depreciation	₹100	[consumption of fixed capital]
~~fact~~ NFIA	₹400	
Indirect Taxes	₹300	

Find out NDP_{FC}

Net indirect tax (NIT) = Tax - Subsidy.
= 300 - 200
= ₹100.

NDP_{FC} = GNP_{MP} - NIT - NFIA - Depreciation
= 5400.

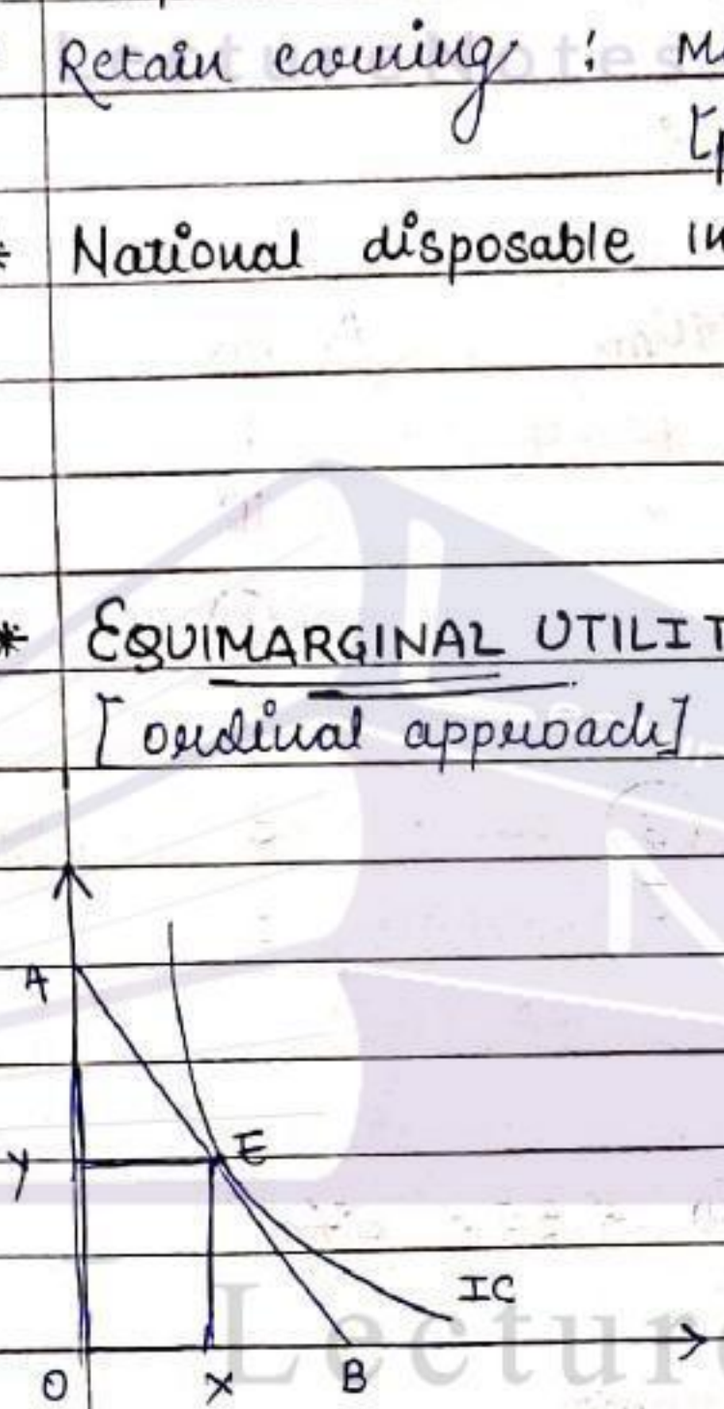
__/__/____

Private income - corporate taxes - retain earning

* Personal income : Income belongs to a person
* Personal disposable Income : Personal income - Personal tax - (PDI) receipts of govt. benefits by govt

* Corporate tax
* Retain earning : Money remain with corporate. [profit earned].
* National disposable income : National Income + NIT + Net current transfer from rest of the world. (benefits received from abroad)

* EQUIMARGINAL UTILITY
[ordinal approach]



i) Max^m satisfaction

ii) $MRS_{xy} = \frac{P_x}{P_y}$

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

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

$\frac{MU_x}{P_x}$: Marginal utility of money (MU_{Mx})

↓

Satisfaction when money is included.

Equimarginal utility

Given the money income & prices of 2 goods, a consumer will distribute his money income in such a way that last rupee spent on each good is equal.

__/__/____

Given, Income = Y

and P_x, P_y

$MU_{mx} = M.U_{my}$

$\frac{P_x}{P_x} \frac{MU_x}{} = \frac{MU_y}{P_y}$ equal when max. satisfaction.

Universal Theory

* Q. Y = ₹35 P_x = ₹4 ; P_y = ₹5

Qty	MU_x	MU_y	MU_{mx}	MU_{my}
1	40	55	10	11
2	36	50	9	10
3	32	30	8	(6)
4	28	20	7	4
5	24	15	(6)	3
6	20	5	5	1

$5x + 3y = 35$

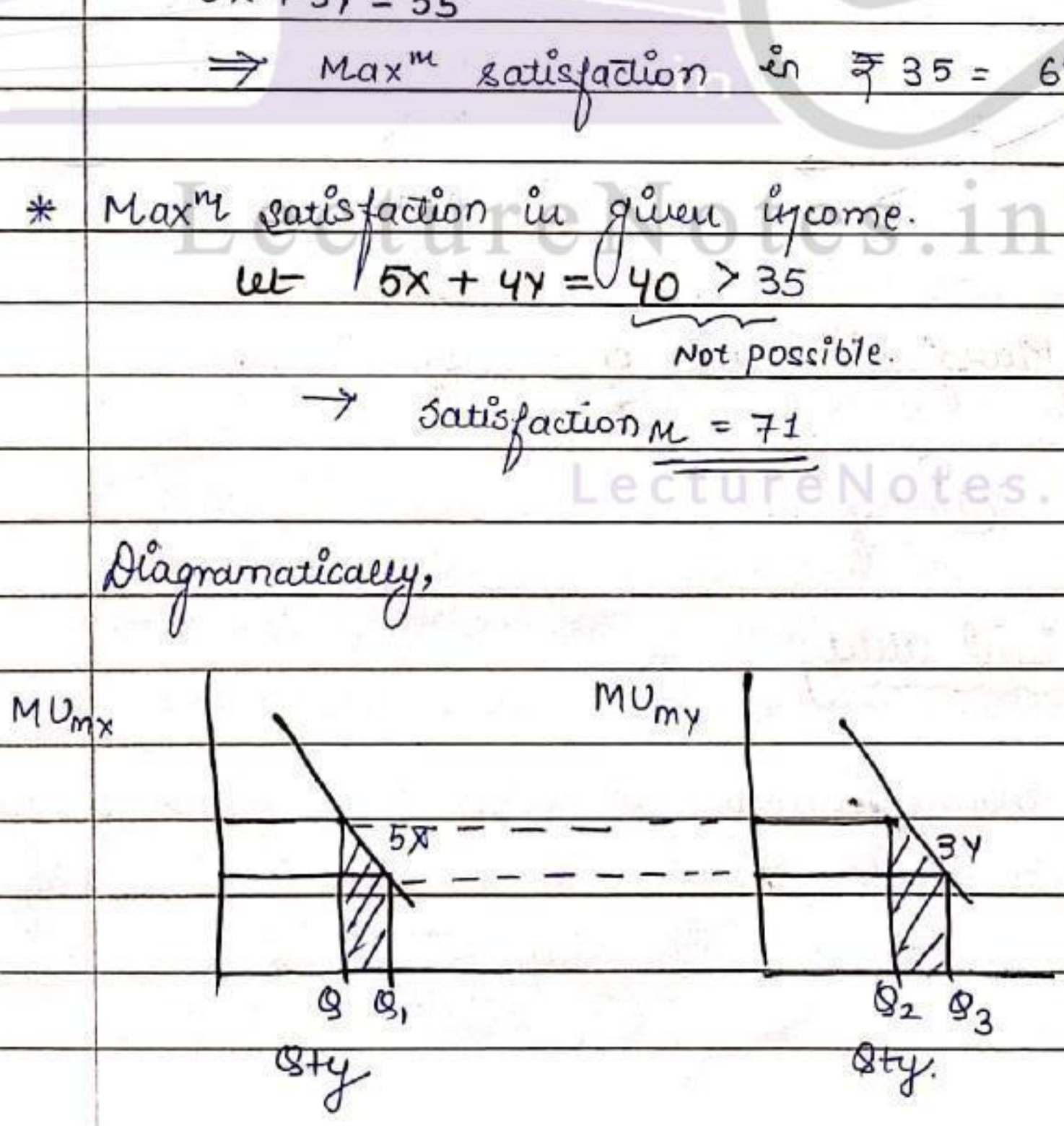
⇒ Max^m satisfaction in ₹35 = 67

* Max^m satisfaction in given income.

let $5x + 4y = \underbrace{40}_{\text{Not possible.}} > 35$

→ Satisfaction$_M$ = 71

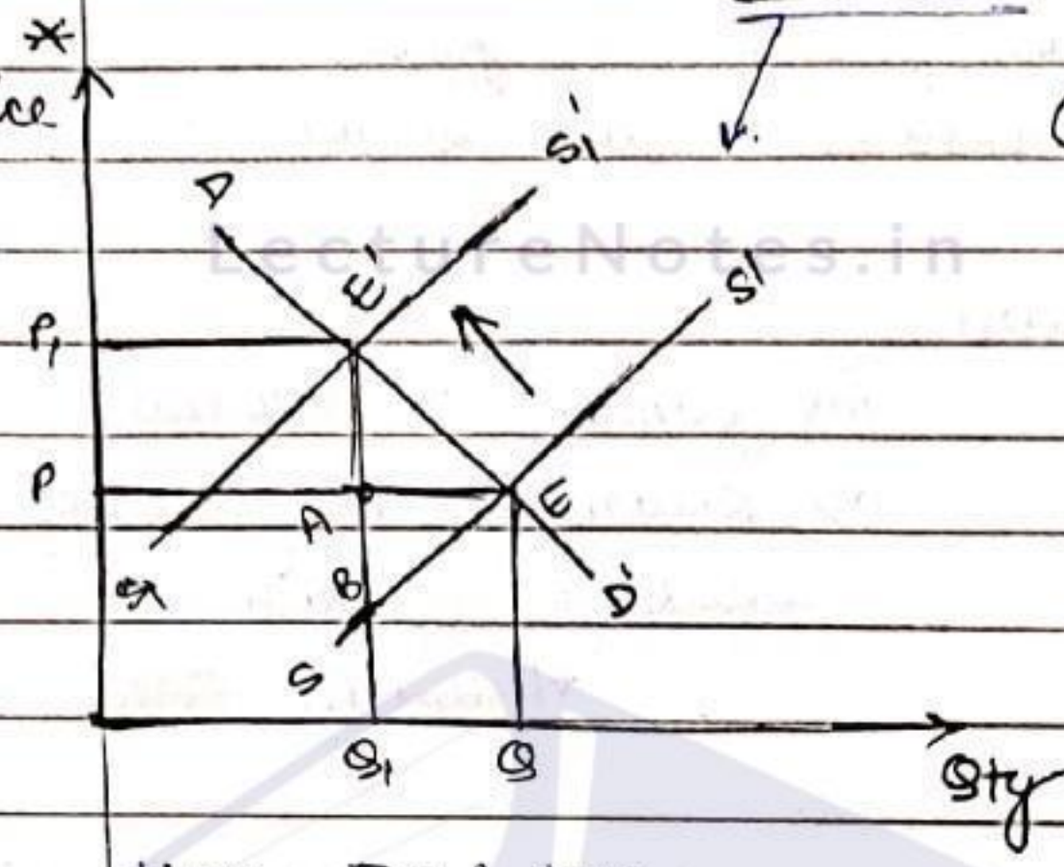
Diagramatically,



National income.

Burden of tax & Incidence of tax. Elasticity

$[Ep^d > 1]$



Here E1B : tax

E1A : Consumer.

AB : producer

E1A + AB

E1A < AB

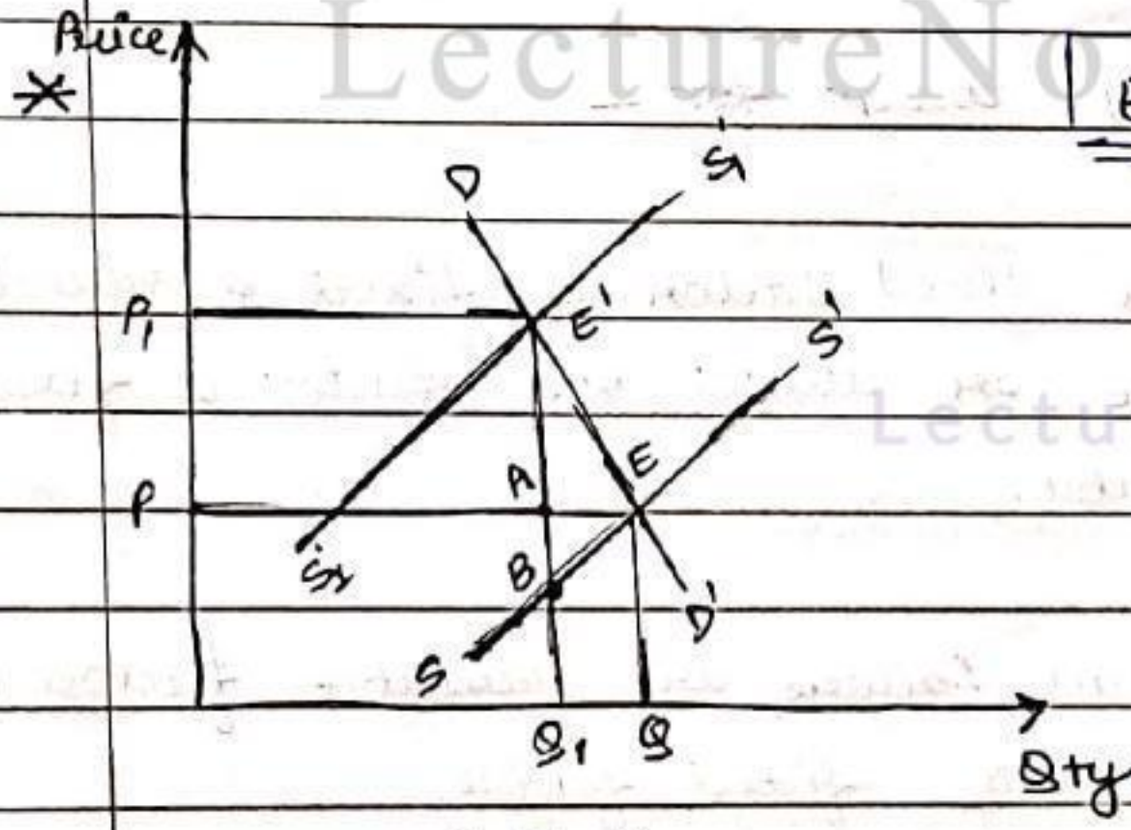
consumer < producer.

$(Ep^d < 1)$

Elastic ($Ep^d > 1$) Inelastic

Producer more — Consumer less

P-less C-more



$[Ep^d < 1]$

AB < E1A

producer < consumer

__/__/____

PRODUCTION

↳ — of form utility.
↳ — of service utility.
↳ Change of state from product to goods.
↳ Time : present in both — and service utility.

* Factors of production

1> Land : Material
11> Labour : Human
111> Capital : material
1V> Organisation : group of people working together
Human.

d> Fixed factor : Factors of production which are fixed throughout production process or which are fixed in short run only.

b> Variable factor : which are variable both in short & long run.

o Time period :— Imp. concept for —

Short run : Here fixed factor is fixed & variable factor is variable or atleast one factor is fixed, others are variable.

Long run : Here all factors are variable factor or there is no — of fixed factor.

Production fun^n

$Q = f(land, labour, ---)$

Q ↓ o/p
f(land, labour, ---) ↓ i/p

MPs- Productivity of individual productivity factor.

(i) Total amt. of o/p produced by given i/p is total product or total o/p.

(ii) Per unit o/p which is used by using 1 unit of o/p: Avg. product

(iii) Addition to total o/p by using 1 more unit of o/p: marginal product.

* Law Production Function 05.09.19

1. Short run 2. Long run

→ 1. Keeping fixed factor fixed. and variable factor variable relationship exist b/w total, average and marginal product studied. under short run production fun^n. This is known as law of variable proportion OR Diminishing returns OR Return to factor.

Keeping fixed factor fixed if we increase the variable factor in a given production, total product, average product & marginal product ...

... first increases, reaches max^m point then diminishes

Total & avg. product remain +ve throughout the production process whereas marginal product diminishes to -ve point.

* Assumptions

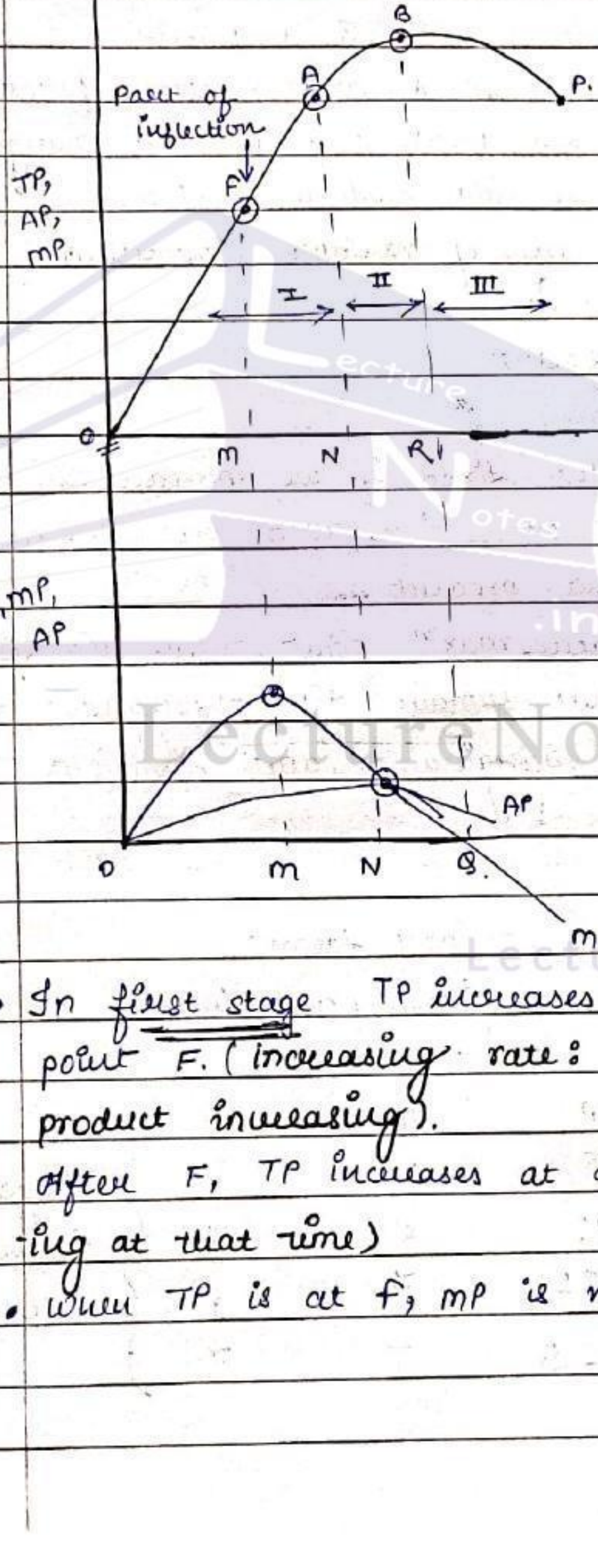
→ Presence of fixed and variable factors.

→ Factors are used in a given proportion.

FF	VF	TP	AP	MP	
1	1	5	5	5	Stage-I Increasing return
1	2	12	6	7	
1	3	21	7	9	
1	4	28	7	7	

__/__/____

1	5	30	6	2	} Diminishing return (stage-II)
1	6	30	5	0	
1	7	28	4	-2	} Negative return (stage-III)
1	8	24	3	-4	



- In first stage TP increases at increasing rate till point F. (increasing rate: At that time marginal product increasing).
- After F, TP increases at diminishing rate (MP is diminishing at that time)
- When TP is at f, MP is max^m.

* Criticism / Limitation

May Not applicable in case of agriculture sector, as it depends on nature / weather cond?

Stage - II

- TP increases, reaches max^m pt., AP diminishes (Both TP & AP are +ve).

~~MP diminishes reaches~~

* At the end of second Stage MP = 0.
- Second stage is known as stage of rational production (maximisation of o/p)
- The producer always want to produce in second stage. [as max^m o/p]

Stage - III

- TP starts diminishing. AP is diminishing (Both are +ve)
- MP is diminishing and reaches to negative value.

* Causes of Increasing Return TP↑ MP↑↓ max^m AP↑ 09.09.19

1) Division of labour.
2) Indivisible fix factor.
3) Increase in efficiency of variable factor (labour).
4) Marginal productivity of fixed factor is negative in first stage.

* Causes of Diminishing Return TP↑ MP↓(0) AP↓.

1) Division of labour.
2) and 3) same.
4) Improper ratio of fixed and variable factors. [MP↓(0)]

* Causes of Negative return MP(-ve) TP↓ AP↓

1) Due to access of variable factor
2) Marginal productivity of variable factor is negative.

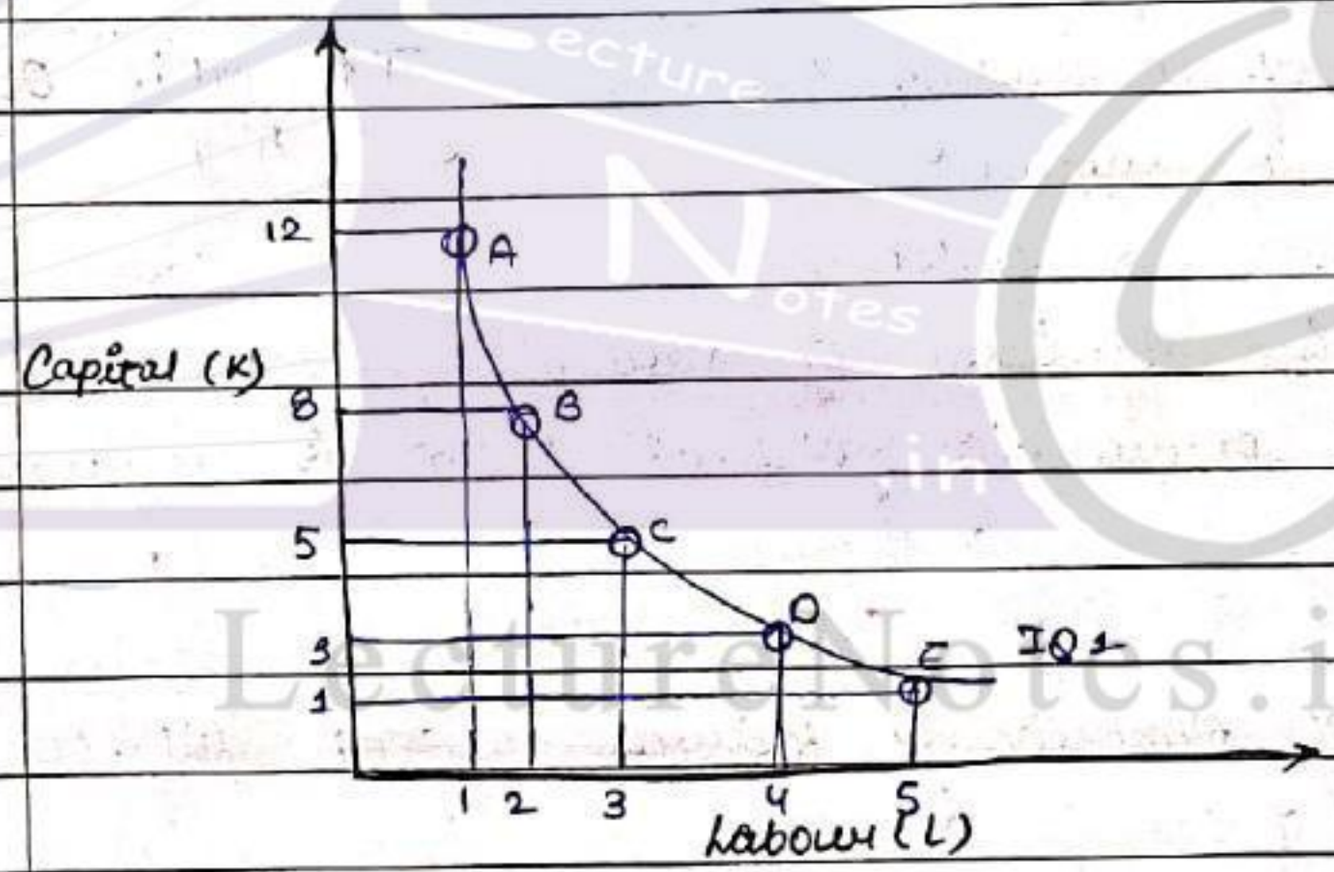
__/__/__

* Long run Production fun^{n}.

* ISOQUANT (Equal product curve)

It is curve representing all possible combinations of 2 factors (capital, labour) which are capable of producing same unit of o/p.

Cond^{n}/ Combination	L	K
A	1	12
B	2	8
C	3	5
D	4	3
E	5	1

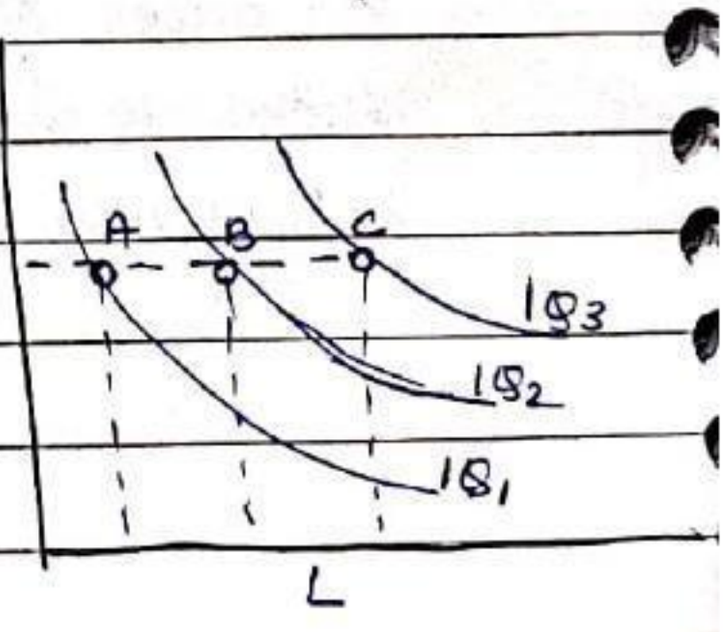


Marginal rate of technical substitution. (MRTS) [same as MRSI

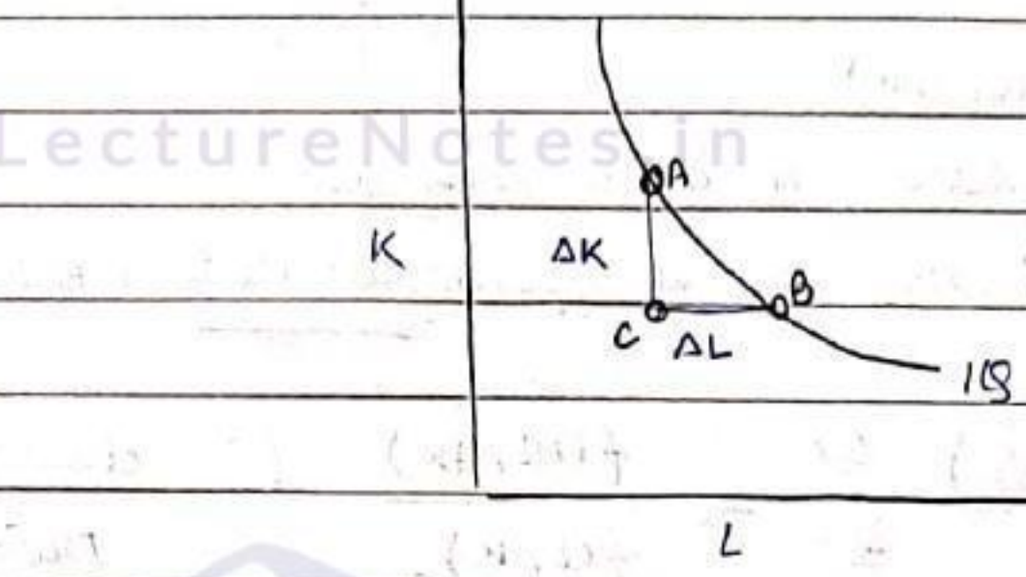
ISOQUANT MAP

Group of isoquant representing different level of o/p.

Higher isoquant represent higher o/p than the lower one.



MRTS :- No. of labour substituted ~~for capital~~ in place of capital to produce same level of o/p is represented by MRTS. It is the slope of IQ or isoquant.



$$MRTS_{LK} = \frac{\Delta K}{\Delta L}$$

$$MRTS_{KL} = \frac{\Delta L}{\Delta K}$$

Loss in o/p = $\Delta K \times MP_K$

Gain in o/p = BC

= Amount increased in labour (ΔL) $\times MP_L$

$\Rightarrow \Delta K \times MP_K = \Delta L \times MP_L$.

$\Rightarrow \frac{\Delta K}{\Delta L} = \frac{MP_L}{MP_K}$.

$$MRTS_{LK} = \text{slope of IQ} = \frac{MP_L}{MP_K}$$

* PROPERTIES OF IQ.

1) Convex to the origin. } Diminishing MRTS.
2) Negative slope.
3) No 2 curves can intersect.
4) Higher IQ curves gives higher o/p.

* IQ is used to define long run production fun^n.

__/__/____

* Return to scale (Longrun).

$Q = f(L, K)$

↓

output

$Q_1 = f(AL, AK)$

where A is a constant.

Change is equiproportionate (both i/p & o/p).

(% change in o/p) $\frac{Q_1}{Q} = \frac{f(AL, AK)}{f(L, K)}$ (% change in i/p)

proportionate.

(I). $\frac{Q_1}{Q} = A$ constant return to scale

Both i/p & o/p change equiproportionally.

(II) $\frac{Q_1}{Q} > A$. (Increasing return to scale)

% Δ in o/p > % Δ in i/p.

(III) $\frac{Q_1}{Q} < A$ (Diminishing return to scale).

% Δ in o/p < % Δ in i/p.

* Return to Scale. 12.09.19

Stage-I

1> Increasing return to scale.

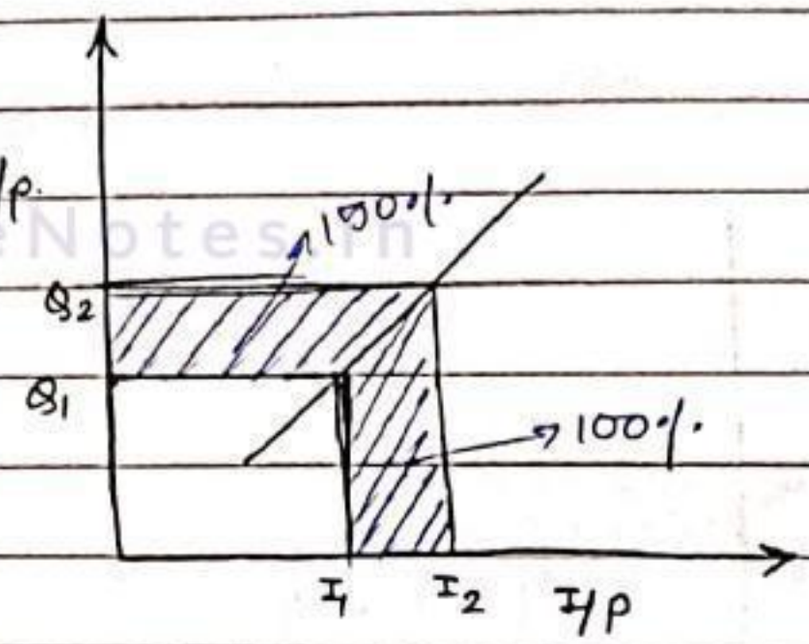
Less i/p : more o/p

when all factors are increased in equal proportion, o/p ~~will~~ increases ~~& it is~~ more proportionately than increase in i/p.

__/__/__

L	K	% Δ in I/P	TP	% Δ in O/P.
1	2	-	100	-
2	4	100%	250	150%

Cardinal :



* First stage is the stage of rational production (maximisation of o/p) because producer is producing max^m o/p in this stage only.

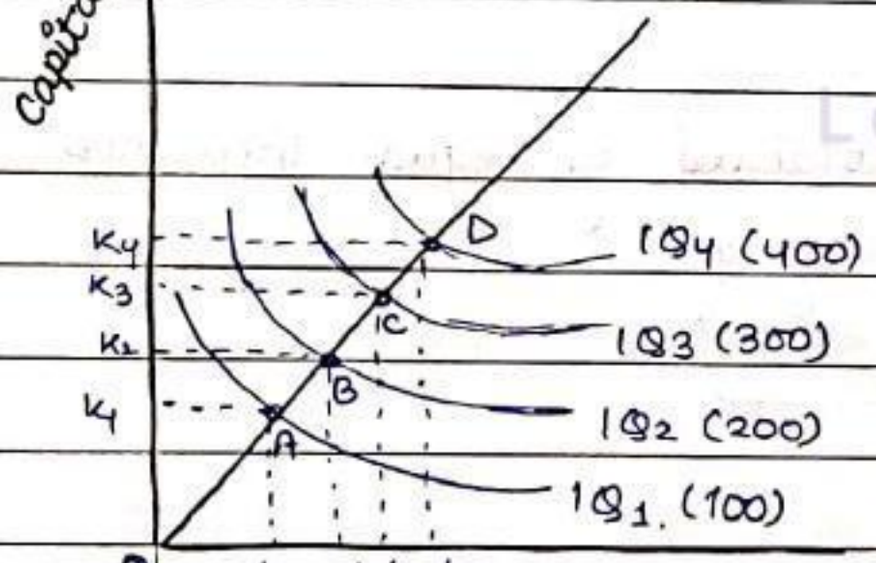
ordinal : a) less i/p same o/p b) same i/p more o/p.

i/p	o/p
80	100
70	100
60	100

Due to that in the given diagram,

OA > AB > BC > CD

[Gap started diminishing b/w IQ]



OA > AB > BC > CD

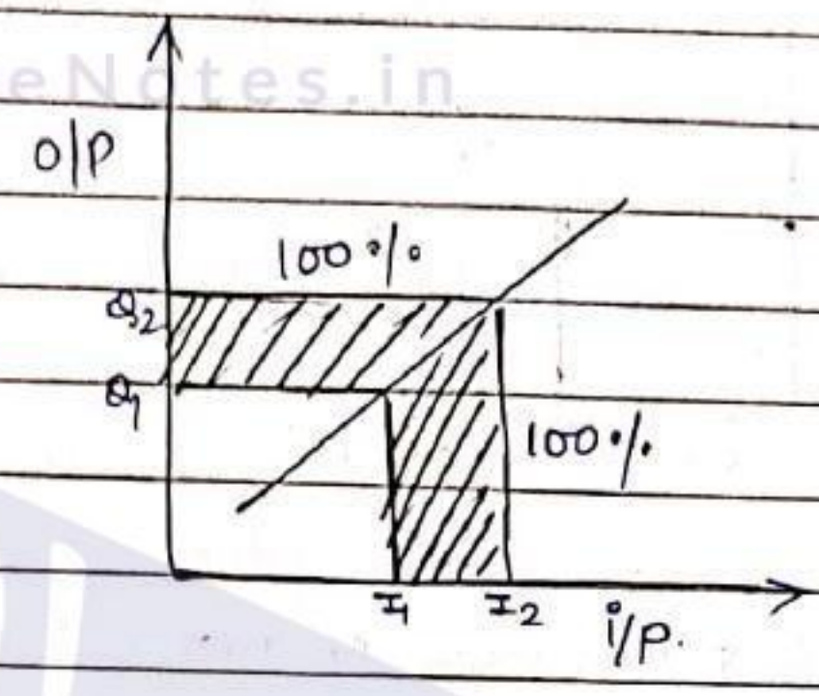
Equal increase in o/p are obtained by small increase in i/p. ~~due to the~~.

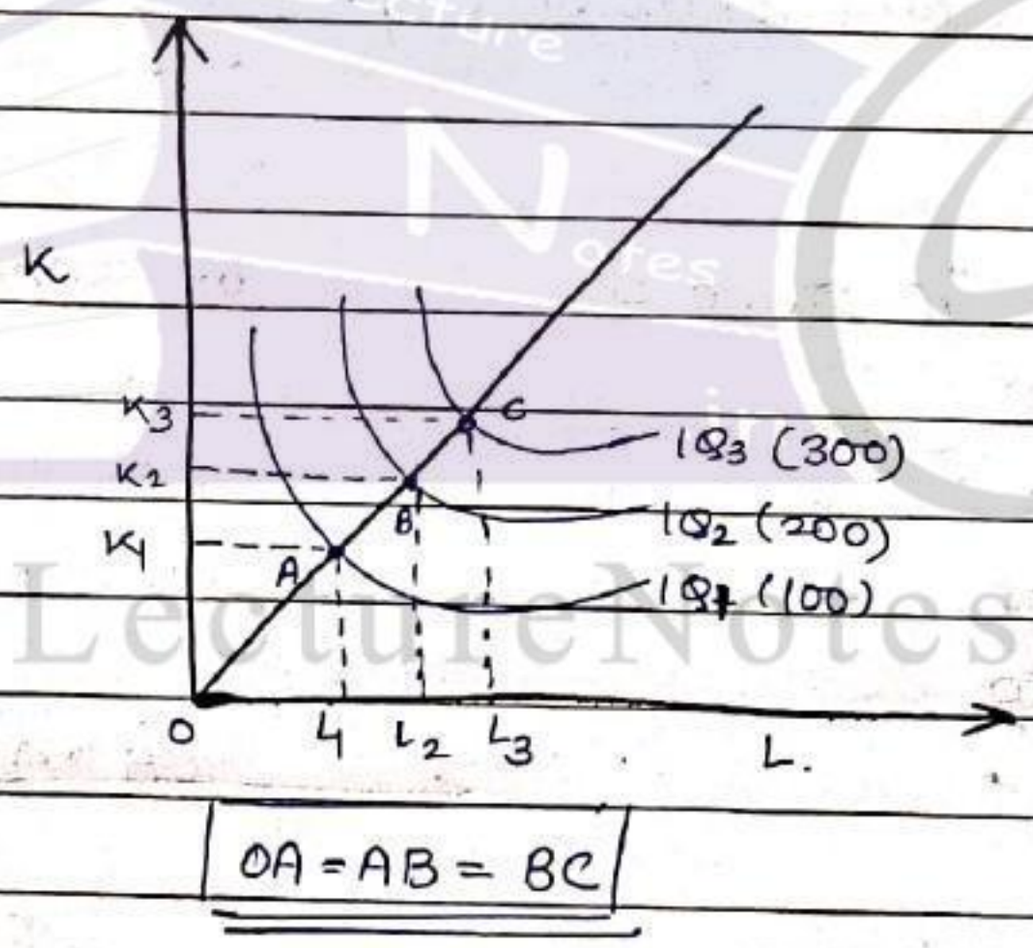
__/__/____

STAGE - II

2) Constant return to scale.

L	K	%Δ in i/p	TP	%Δ in o/p.
1	2	–	100	–
2	4	100%	200	100%





Gap b/w IQ's are constant.

$$OA = AB = BC$$

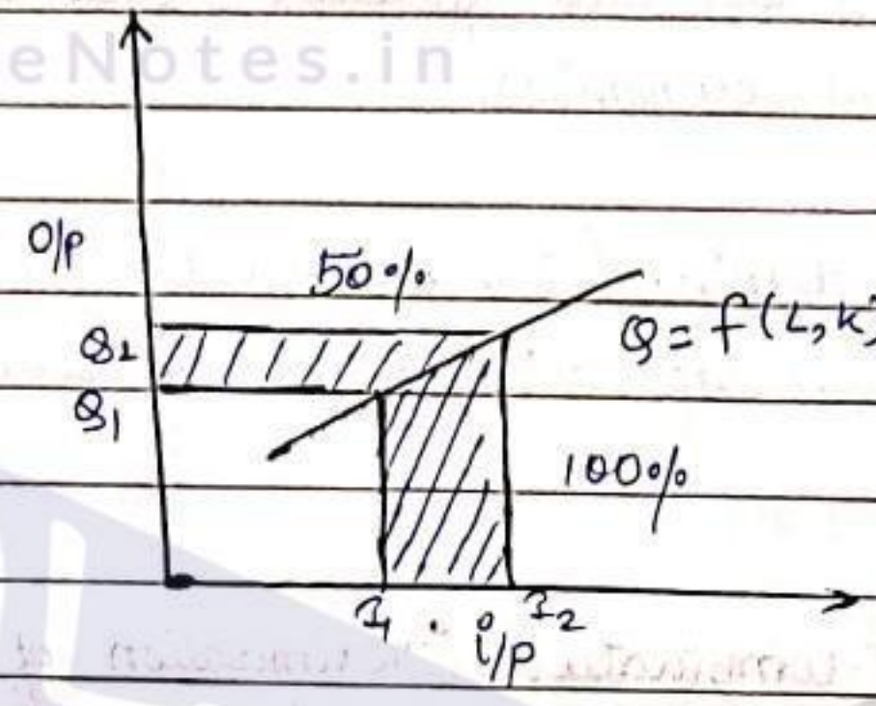
Equal increment in o/p obtained by equal increment in i/p that's why in this diagram.

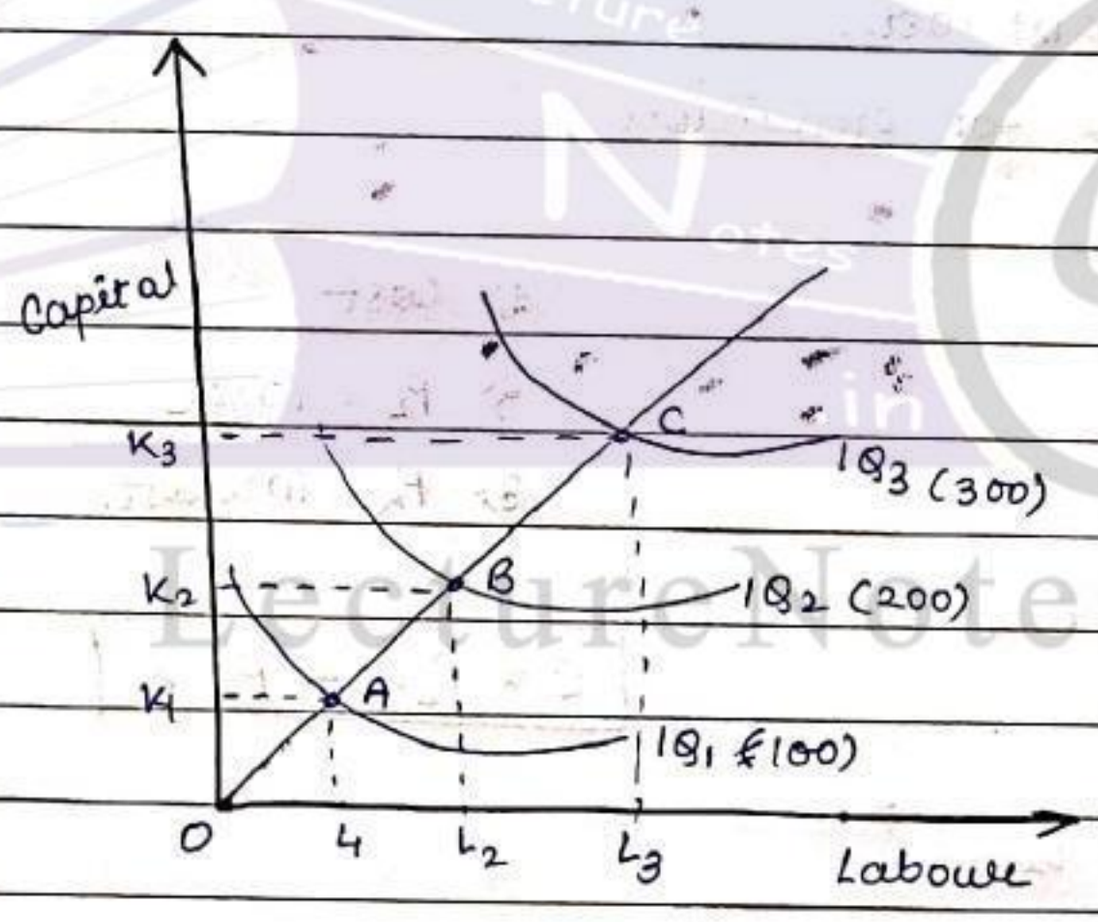
$$OA = AB = BC$$

Stage - III

3. Diminishing returns to scale.

L	K	% Δ in i/p	TP	% change in o/p.
1	2	-	100	-
2	4	100%	150	50%





OA < AB < BC

Equal increase in o/p is obtained by more increase in i/p due to that the gap b/w IQ's goes on increasing.

* Causes of Increasing return to scale.
Why first stage occurs in long run production fun^n.

i) Raw material ii) Labour iii) Transportation cost.

__/__/____

Causes of IRS known as economies of scale ~~whereas~~

Economies of conc^{n} : Industrial area

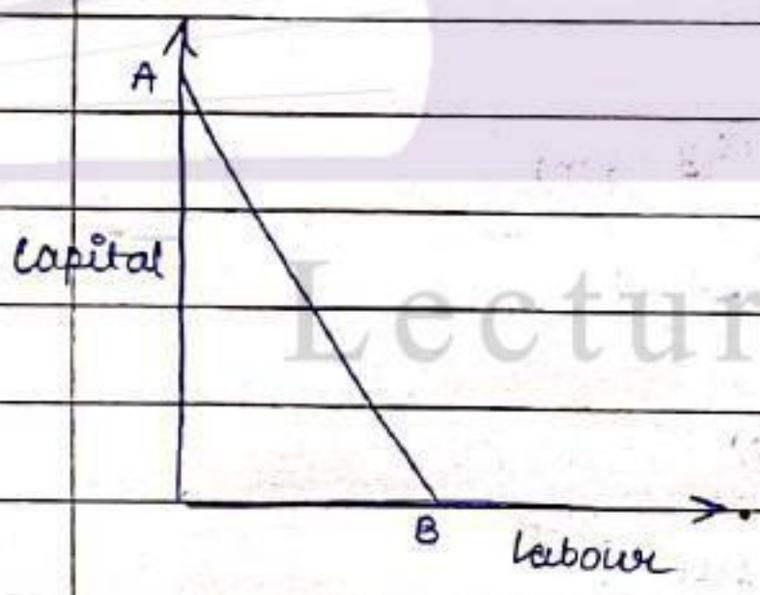
* Due to indivisible factors.

* Economies of disintegration / integration process.
Managerial cost will decrease total cost of production.
(managerial economies).

* Causes of diminishing return to scale.
It is known as diseconomies of scale

16.09.19

* Least Cost Combination (maximisation of o/p OR Producer's equilibrium)
Max^{m} o/p in least cost.
AB is cost line for production.
Isocost line



1> Cost
2> P_L = wage
3> P_K = interest.

$$C = P_L \cdot L + P_K \cdot K$$

y intercept, money used on capital only, no labour cost.

$\Rightarrow$ $C = K \cdot P_K$

OA $\Rightarrow$ = $\boxed{\frac{C = K}{P_K}}$ ——— (1) where K is qty. of capital

x-intercept,

$\Rightarrow$ $C = L \cdot P_L$.

OB = qty. of labour = $\frac{C}{P_L} = L$.

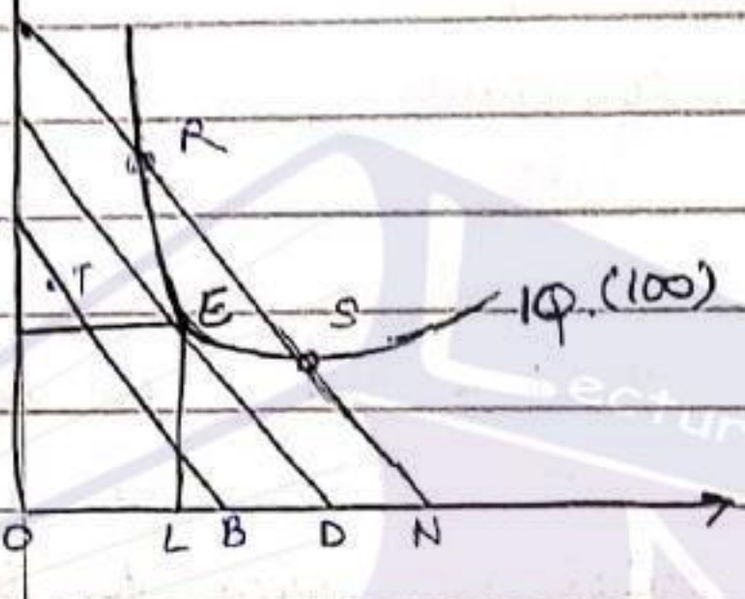
Slope of AB = Isocost line = $\frac{OA}{OB}$

$= \frac{C/A_K}{C/A_L}$

$= \frac{P_L}{P_K}$ = $\frac{\text{wage}}{\text{Interest}}$.

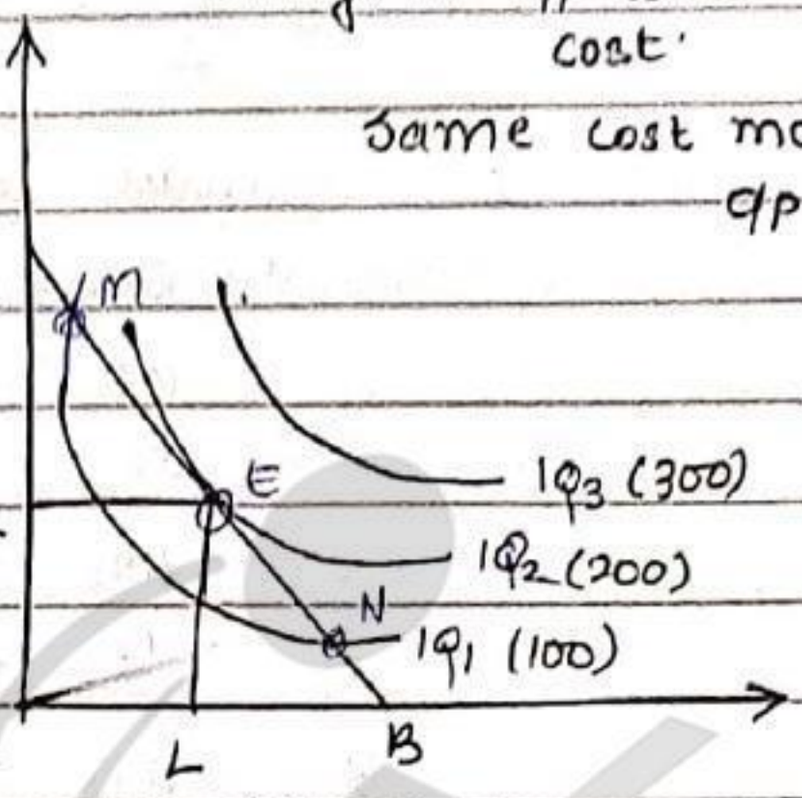
I. Same o/p less cost.

Changing in cost with same o/p.



II. Change in o/p with same cost.

Same cost more o/p.

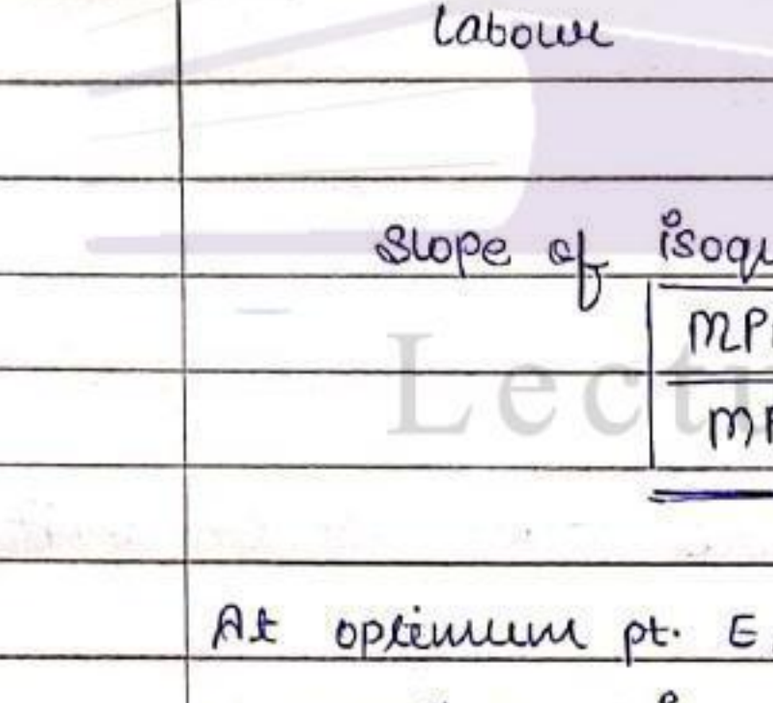


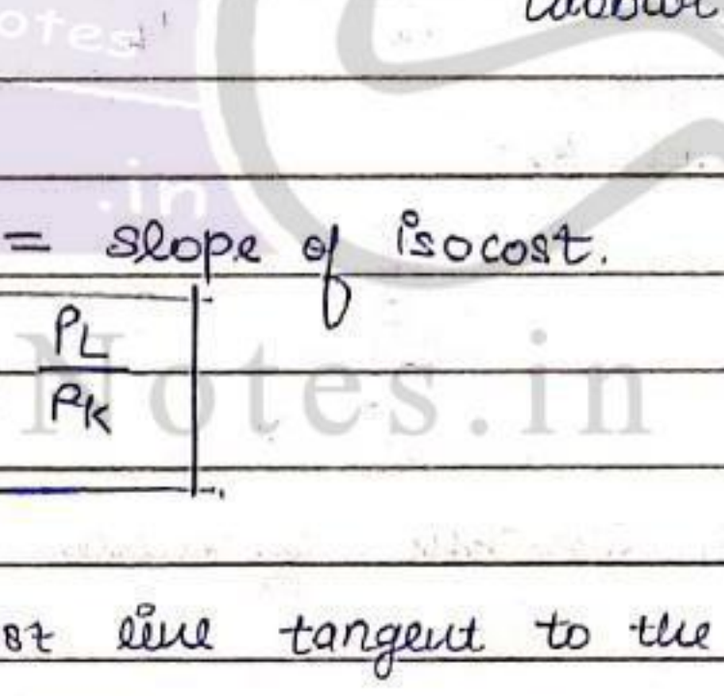
Slope of isoquant = slope of isocost.

$$\frac{MP_L}{MP_K} = \frac{P_L}{P_K}$$

At optimum pt. E, isocost line tangent to the IQ2 representing max^m o/p with min^m cost.

$\frac{\Delta P_L}{\Delta P_K}$





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* A firm is producing qp using labour & capital in such qty. that marginal product of labour is 15 & that of capital is 8, wage of labour is 3, price of capital is 2. Is the firm using efficient factor combination. If not what it should do to achieve economic efficiency

$$\frac{MP_L}{MP_K} = \frac{P_L}{P_K}$$

$$\frac{15}{8} \neq \frac{3}{2}$$

Not efficient combination.

Substitute, labour or capital to achieve.

$$\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$$

If $\frac{MP_L}{P_L} > \frac{MP_K}{P_K}$ substitute labour for capital.

If $\frac{MP_K}{P_K} > \frac{MP_L}{P_L}$ substitute capital for labour.

Acc to Q,

$$\frac{15}{3} = \frac{8}{2}$$

$$5 > 4.$$

∴ For economic efficiency substitute labour ~~or~~ for capital.

* $Q = 10L + 20K$. $P_L = 3$ $P_K = 2$

$MP_L = \frac{dQ}{dL} = 10.$ min^m cost. max^m o/p. [Q: Total o/p]

$MP_K = \frac{dQ}{dK} = 20.$

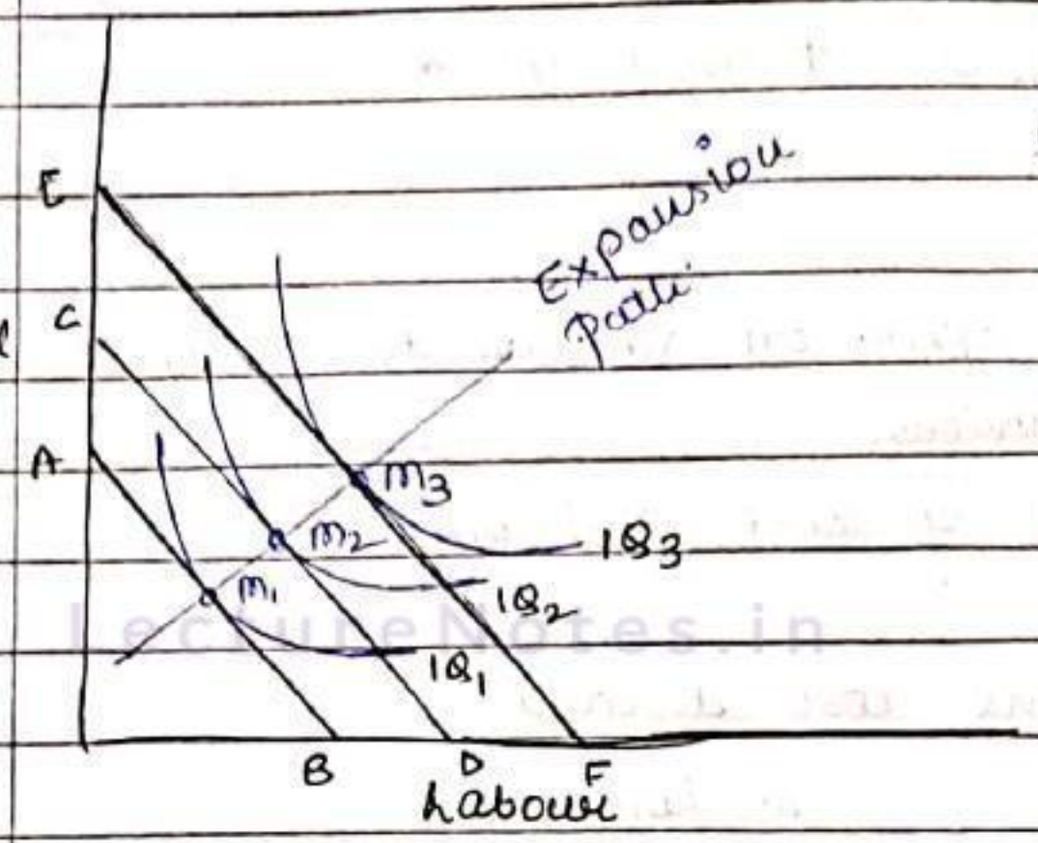
$$\frac{10}{20} \neq \frac{3}{2}$$

⇒ Then same procedure as above

Price factor curve

__/__/____

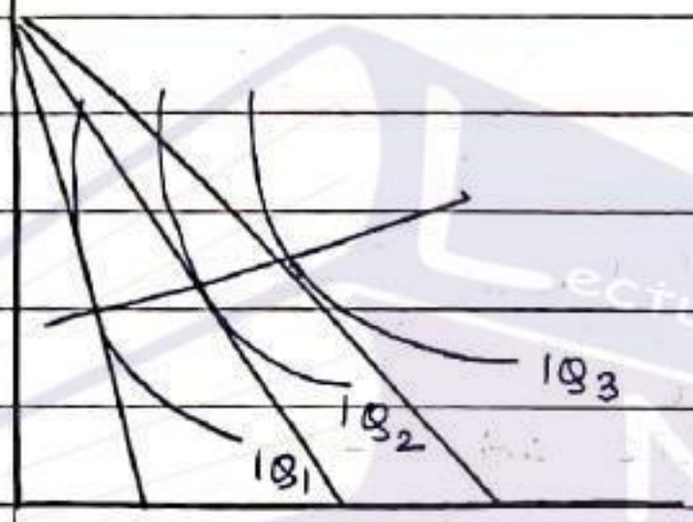
*



Expansion path represents locus of ~~various levels of o/p~~ equilibrium pts. of various levels of o/p.

*

(PFC with change in L)



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17.09.19

* COST FUNCTION *

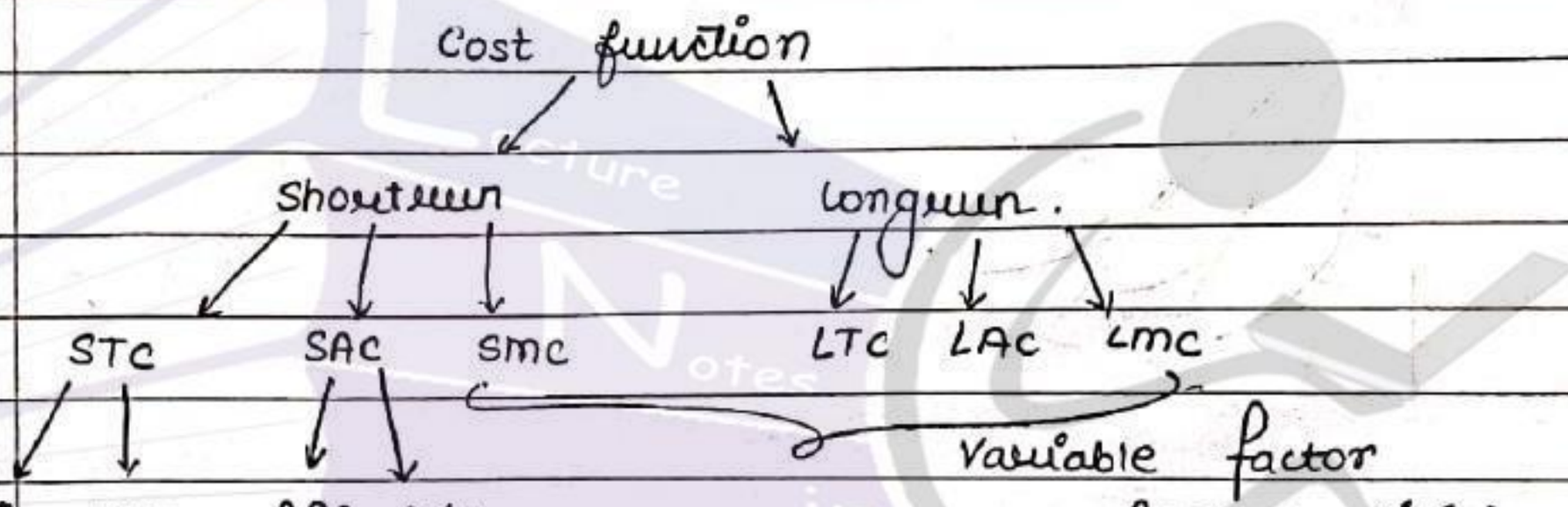
Part of production

Cost is the amt. spend on various factors of production to hire ~~Higher~~ their services.

It is the relation of cost and o/p.

Depending on time cost divided as

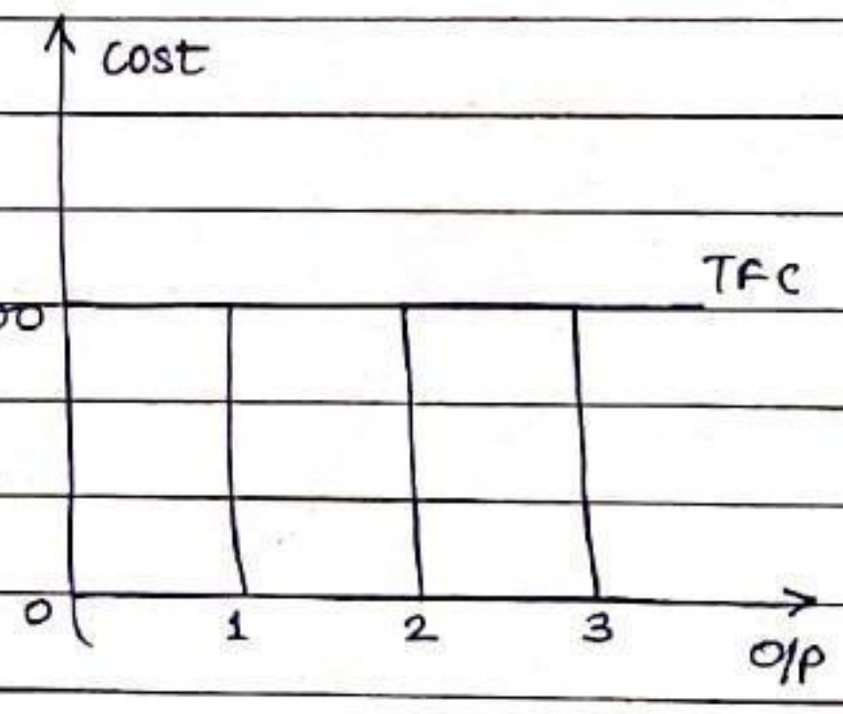
1. Shortrun (fixed factor)
2. Longrun. (Variable factors)



* TFC or Total fixed cost (Rent, maintenance cost)

The amount spend on fixed factors of productions to hire their services known as ~~fix cost~~ TFC.

Output	Q	TFC	TVC
	0	100	0
	1	100	30
	2	100	50
	3	100	60
	4	100	65
	5	100	675
	6	100	95
	7	100	185



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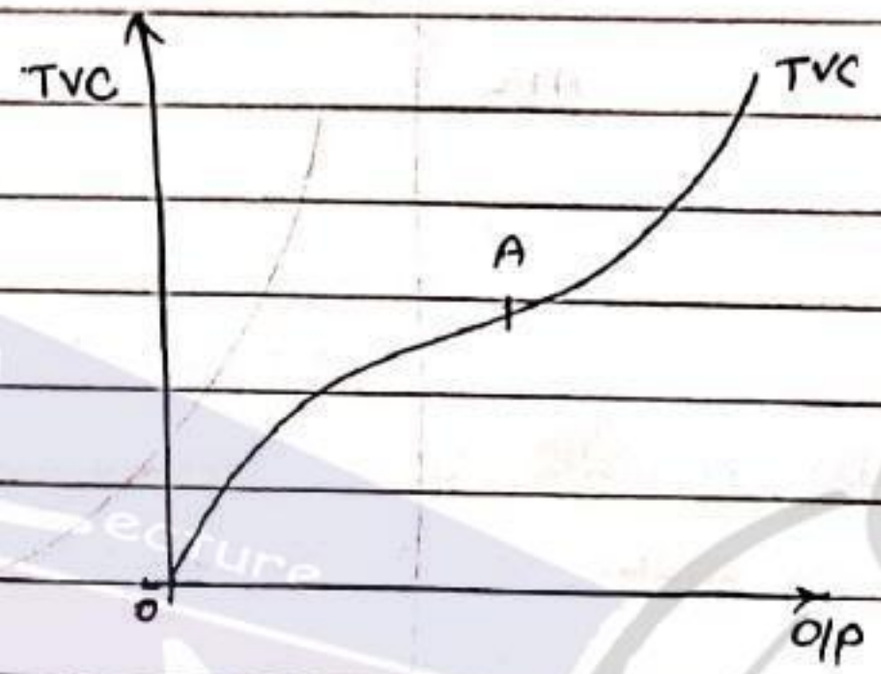
8	100	165
9	100	~~126~~ ~~165~~ 215
10	100.	275

to

* Total variable cost or TVC. (wages, interest)
The amount spend on variable factors of productions to hire their services known as TVC.

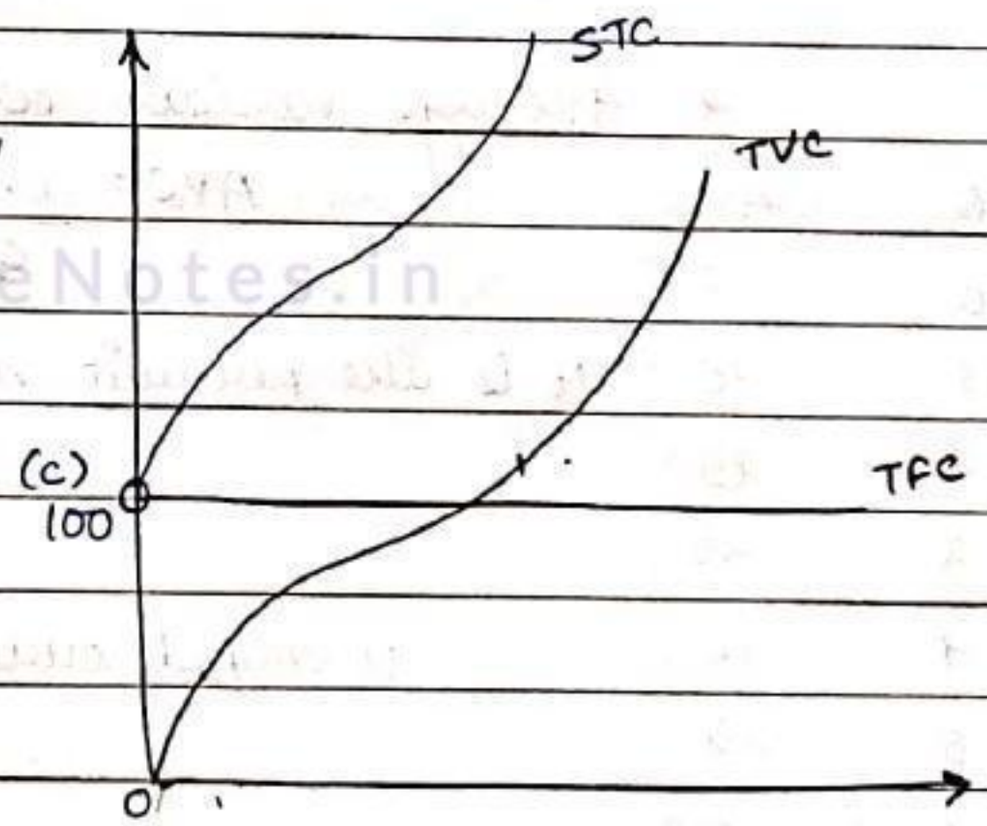


TVC is inverse "S" shaped curve because first it increase at an increasing rate. After a particular pt. it increase at diminishing rate.

* Shortrun total cost (STC) [TFC + TVC]

Q	STC
0	100
1	130
2	150
3	160
4	165
5	175
6	195
7	225
8	265
9	315
10	375

~~Tcf~~
*TFC can never starts from zero.



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* Average fixed cost (AFC)

It is the per unit cost which is derived by dividing Total fixed cost with o/p of

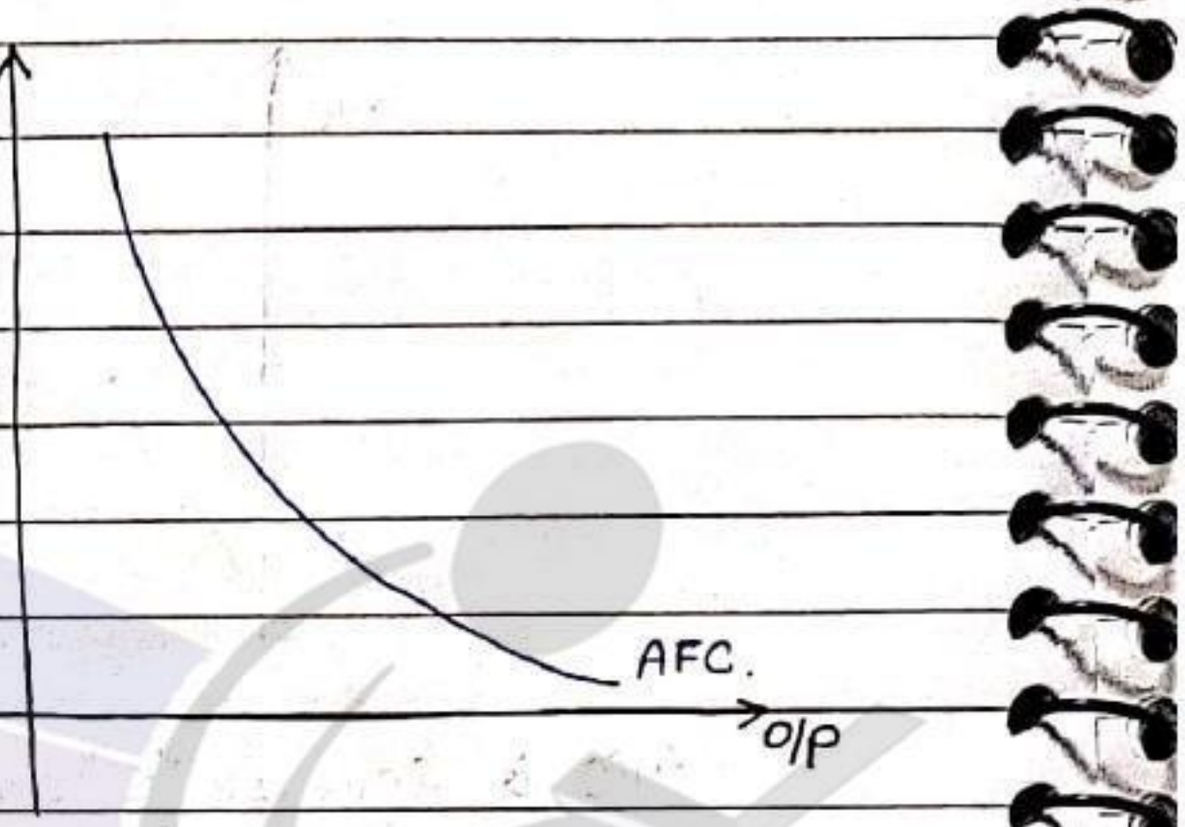
OR

~~It is the per unit or co~~ cost

It is the per unit fixed cost or to produce one unit of o/p.

$$= \frac{TFC}{Q}$$

Q	AFC
0	-
1	100
2	50
3	33·3
4	25
5	20
6	16·6
7	14·2
8	12·5
9	11·1
10	10



(Rectangular hyperbola)

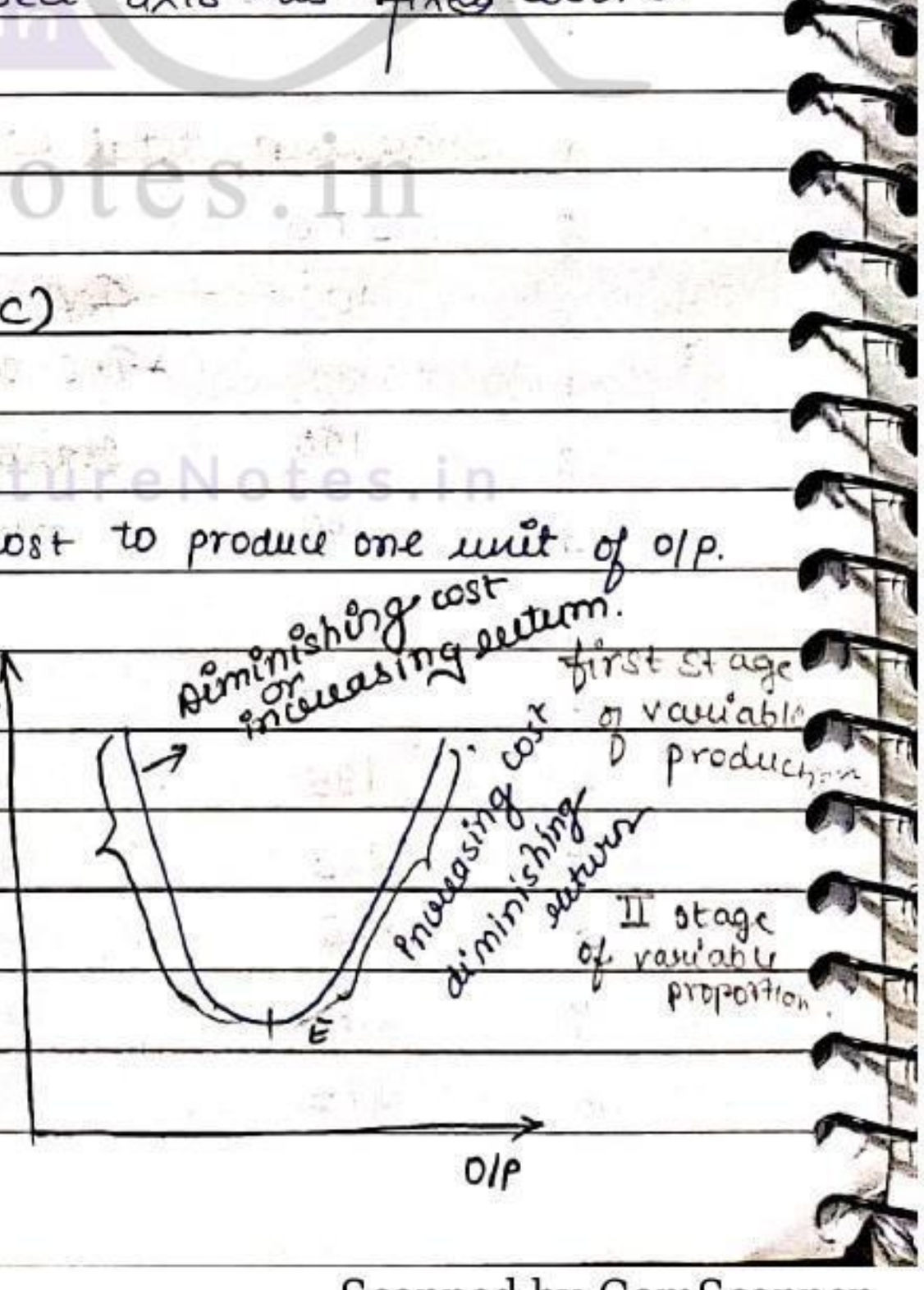
It never intersect axis as fixed cost. is there.

* Average variable cost (AVC)

$$AVC = \frac{TVC}{Q}$$

Q	AVC
0	0
1	30
2	25
3	20
4	16
5	15
6	15·8
7	17·9
8	20·6
9	23·9
10	27·5

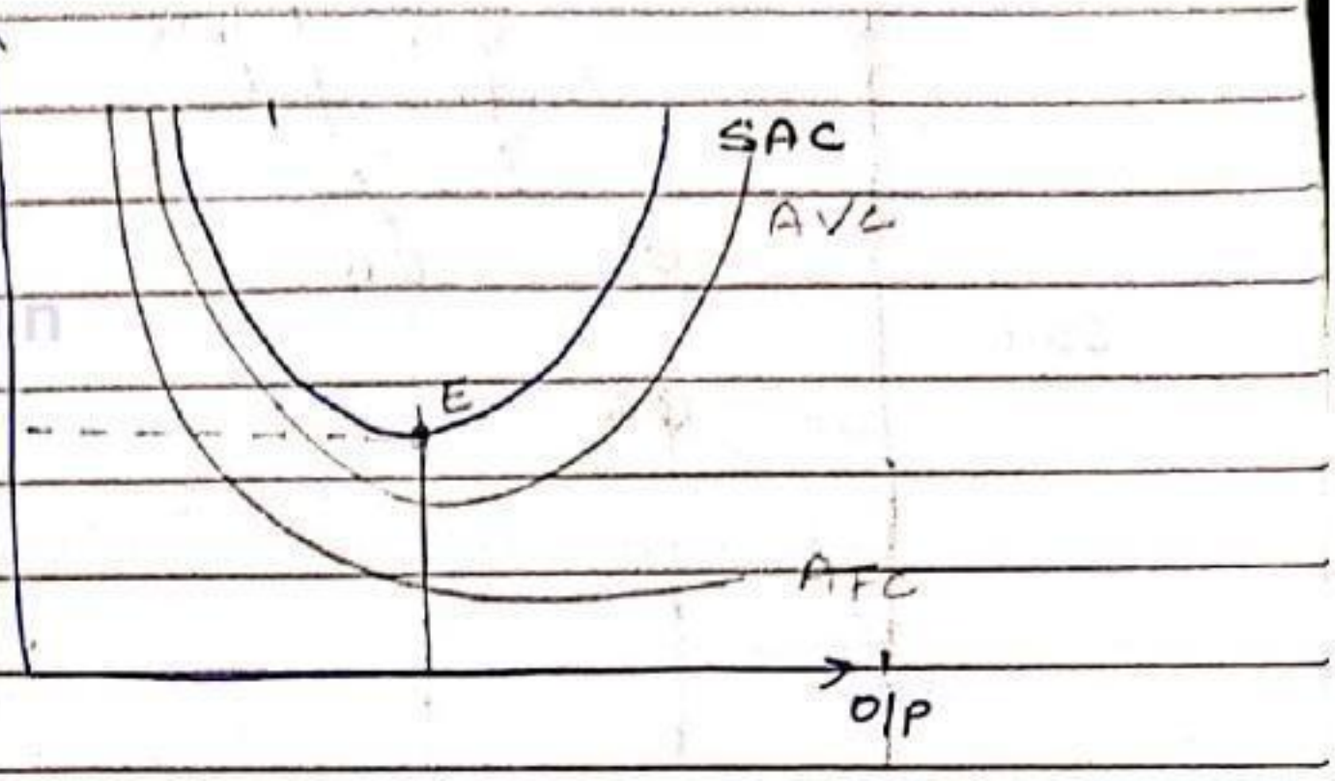
U shaped curve.



* Shortrun average cost (SAC)

$$SAC = AFC + AVC = \frac{STC}{Q}$$

Q	SAC
0	0
1	130
2	75
3	53.3
4	41.25
5	35
6	32.5
7	32.14
8	33.12
9	35
10	37.5



'U' shaped curve.

Point 'E' is optimum pt. at which the producer is producing maxm level of o/p with minm cost. [Best combination pt.].

* There is application of law of variable proportion.

a) Causes for increasing return is responsible for diminishing cost.

b) Same as above increasing cost & diminishing return.

* Shortrun marginal cost (smc)

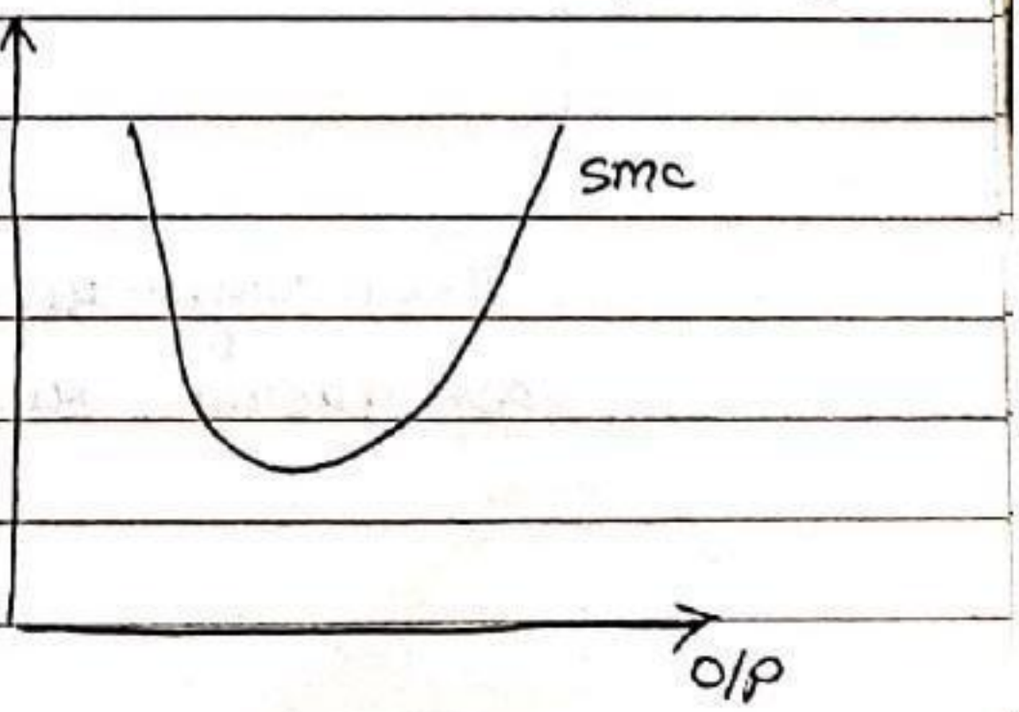
Addition to the Tc by producing one more unit of o/p.

$$SMC = TC_n - TC_{n-1}$$

$$= \frac{\Delta TC}{\Delta Q} = \frac{d(TC)}{dQ}$$

Q	SMC
0	100
1	30
2	20
3	10
4	5
5	10
6	20
7	30
8	40
9	50
10	60

'U' shaped due to law of variable proportion.



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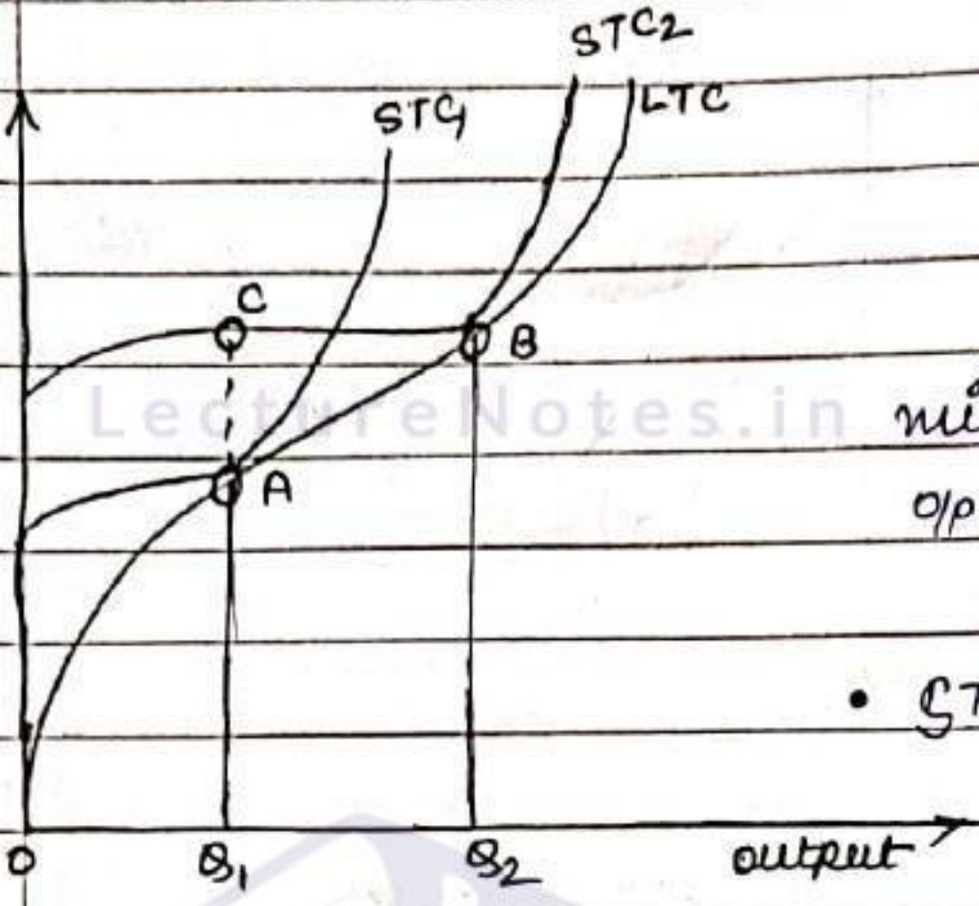
19.09.19

* Longrun Cost:

The cost increased due to various factor of production to hire their services.

1) Total cost.



STC ≥ LTC

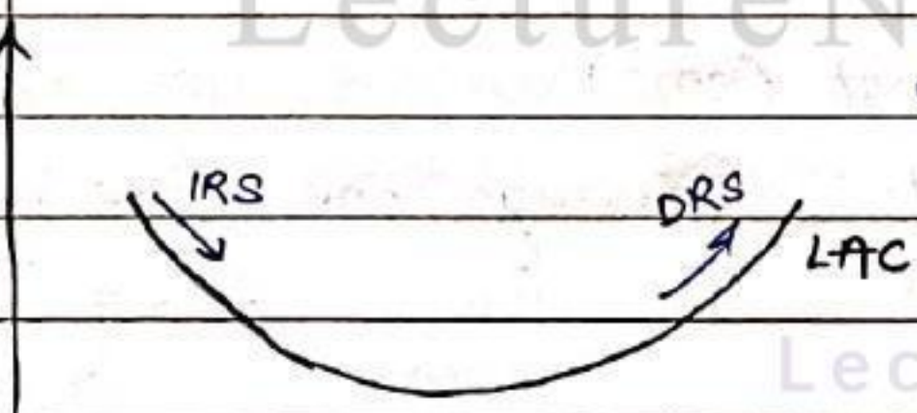
Long run total cost is the min^m cost at which each level of o/p can be produced.

- STC1 is tangent to LTC.
- max^m o/p with min^m cost.

	STC1	STC2	
	①	②	
OQ1	✓	×	(CQ1 > AQ1)
OQ2	×	✓	BQ2

* longrun average cost (LAC)

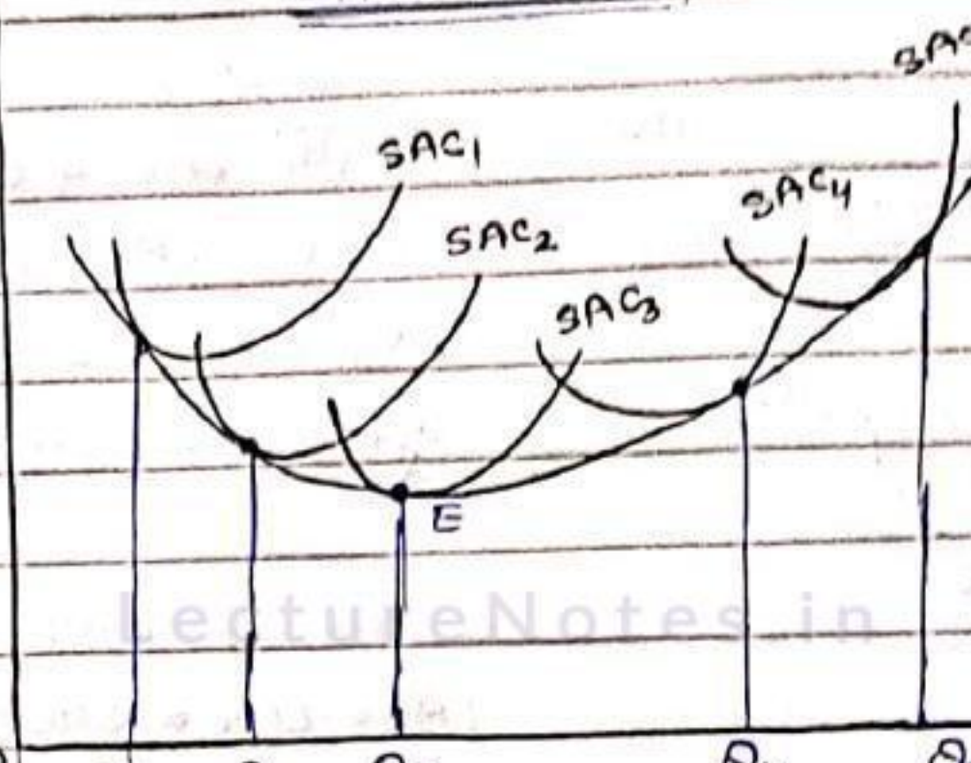
$$LAC = \frac{LTC}{Q}$$



- In LAC first AC is diminishing due to economies of scale. After the optimum pt. AC increases due to diseconomies of scale.

Increasing return to scale : IRS.
Decreasing return to scale : DRS.

SAC & LAC



- LAC is also known as envelope curve as it envelopes no. of SAC_s fluid it.
- E is the optimum pt. where LAC is tangent to SAC_3.
- * Before pt. E, LAC is tangent to SACs at their falling position. After the pt. E LAC tangent to SAC at their rising part.

* Because before pt. E marginal productivity of factors negative. all factors are underutilised.
After pt. E, factors are overutilised.

* Longrun marginal cost (LMC)

$$\therefore LMC = LTC_n - LTC_{(n-1)}$$

$$= \frac{\Delta TC}{\Delta Q} \qquad \frac{d(TC)}{dQ}$$

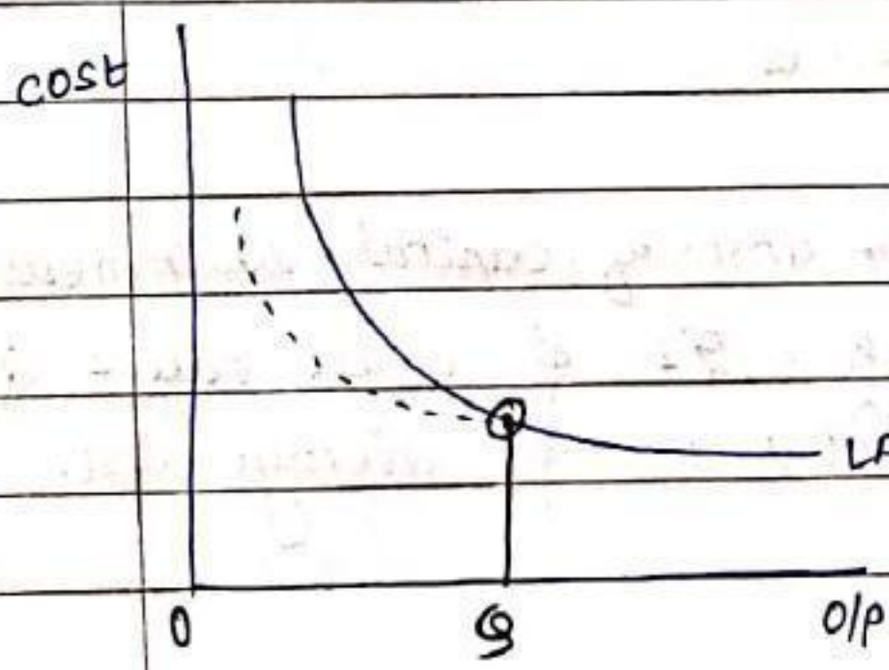
Addition to TC by producing one more unit.

* MODERN THEORY OF COST. *

Causes of LAC as 'L' curve

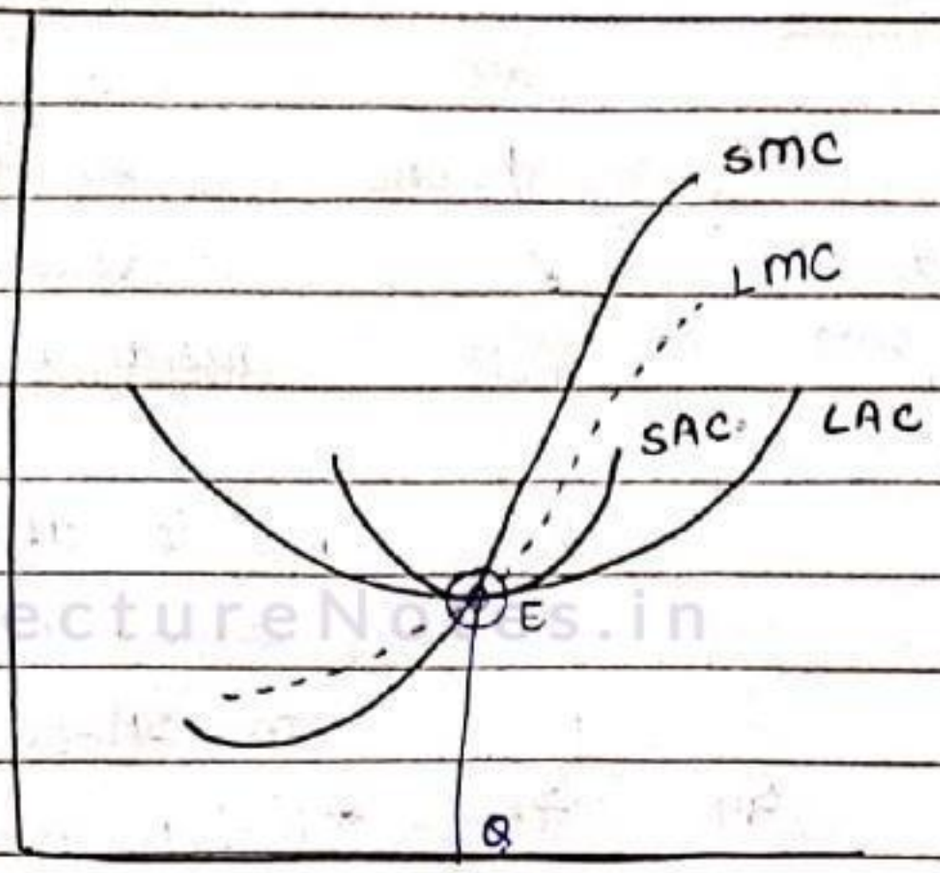
* LAC

① Technical cost
② Managerial cost



LAC ≤ SAC

* Relation b/w different type of cost. (cost curves) —



① LAC ≤ SAC

② LAC & LMC

at E, LAC = LMC

before E, LAC > LMC

after E, LAC < LMC.

③ At optimum pt. E,

LAC = LMC = SAC = SMC.

* Suppose cost fun^n of a firm

$$C = 10 + 4Q + Q^2$$

Find out fixed cost, TVC. and marginal cost.

Total fixed cost = 10

Total variable cost : TC - TFC

$$10 + 4Q + q^2 - 10$$

$$= 4Q + q^2$$

Total marginal cost : $\frac{d}{dQ}(TC)$

$$= 4 + 2q.$$

If $q = 20$.

TFC = ₹10 TVC = $4 \times 20 + (20)^2$

$= 80 + 400.$

$= 480$

* A firm's production fun^n is

$$Q = 2\sqrt{K \cdot L}$$

in short run. The firm's amt. of capital equipment at K=100. The rental rate of K = ₹1 & wage rate = ₹4. Calculate the shortrun Total cost & average cost.

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Rental rate = price of capital

$Q = 2\sqrt{KL}$; $K = 100$

$P_K = ₹1$

$P_L = ₹4$

$\Rightarrow \quad Q = 20\sqrt{L}.$

$Q^2 = 400L$

$\frac{Q^2}{400} = L$

* If Q given substitute it

$TC = P_K \cdot K + P_L \cdot L.$

$= 4 \cdot \frac{Q^2}{400} + 1(100).$

$STC = \frac{4Q^2}{400} + 100. = \frac{Q^2}{100} + 100$

$SAC = \frac{Q^2/100 + 100}{100}$

* If $Q = A(KL)^{0.5}$. what is the short run cost when $K=100$ and find out the marginal cost.

$Q = A(100 \cdot L)^{0.5}$

$Q = A\sqrt{100 \cdot L}$

$Q^2 = A \cdot 10 \cdot L.$

$\frac{Q^2}{100} = A^2L. \Rightarrow \frac{Q^2}{100A^2}$

$STC = \frac{Q^2}{100A^2} \cdot P_L + 100 \cdot P_K.$

Marginal cost $= \frac{2Q}{100A^2} \cdot P_L$

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23.09.19.

* MARKET *

* features.

Market is an area where buyers & sellers interacting with each other with a particular product & price.

There is a constant competition b/w buyers & sellers.

Buyers always want to purchase at less price whereas sellers always want to sell at higher ~~fair~~ price.

Market

Perfect competition | Monopoly | Monopolistic | oligopoly (Duopoly)

* Buyer and seller.

Perfect competition :- large buyer and large seller.

Monopoly :- large buyer, one seller.

Monopolistic :- large buyer, ~~few~~ large seller. ~~(2 seller)~~

oligopoly : large buyer, few seller (2 seller)

* Product.

Perfect comp^{n} : Homogeneous / identical product.

Monopoly : Single product

Monopolistic : Differential product (Products are different from each other in terms of quantity, quality, color, company, shape etc.

They are substitute of each other but not perfect substitute)

oligopoly : Products are either homogeneous or differential

* Price

Perfect comp^{n} : uniform price.

__/__/____

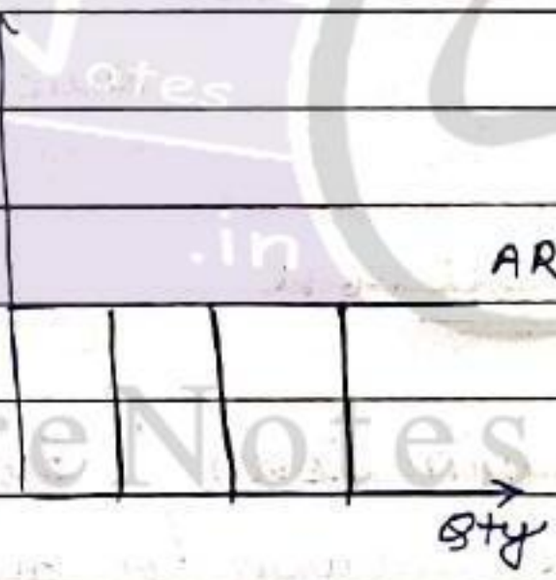
- Monopoly: Price discrimination
  Monopolistic :- Either similar or differential but the difference is not much.
  Oligopoly: Either similar or differential.

* Control over market

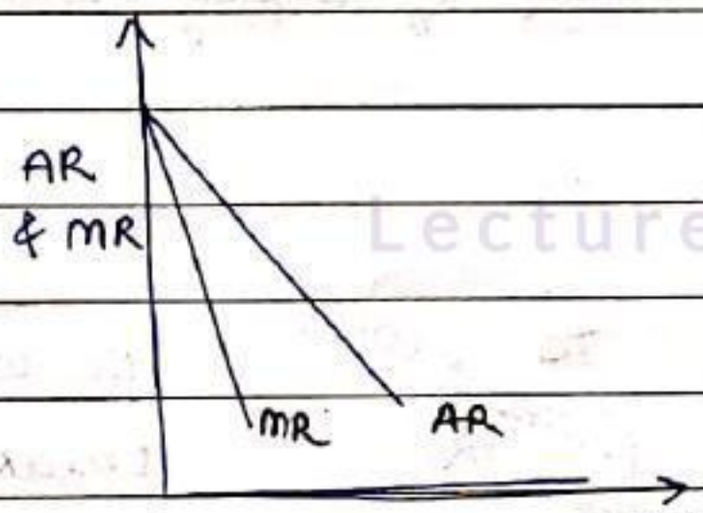
Perfect comp^{n}: lack of control. Seller is price taker.
Monopoly: max^{m}. The seller is the price maker.
Monopolistic: less than monopoly & oligopoly and more than perfect comp^{n} seller is the price taker.
oligopoly :- Seller is the price taker. ~~Con~~ less than monopo-ly, more than perfect comp^{n} & monopolistic.

* Demand curve

Perfect comp^{n} :

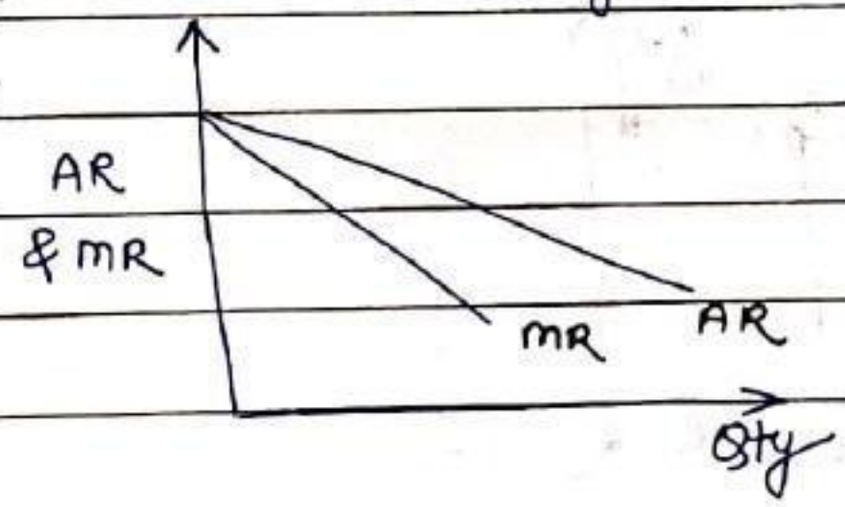


Monopoly :



Inelastic demand. $Ep^{d} < 1$
(steeper curve).

Monopolistic :-



$Ep^{d} > 1$

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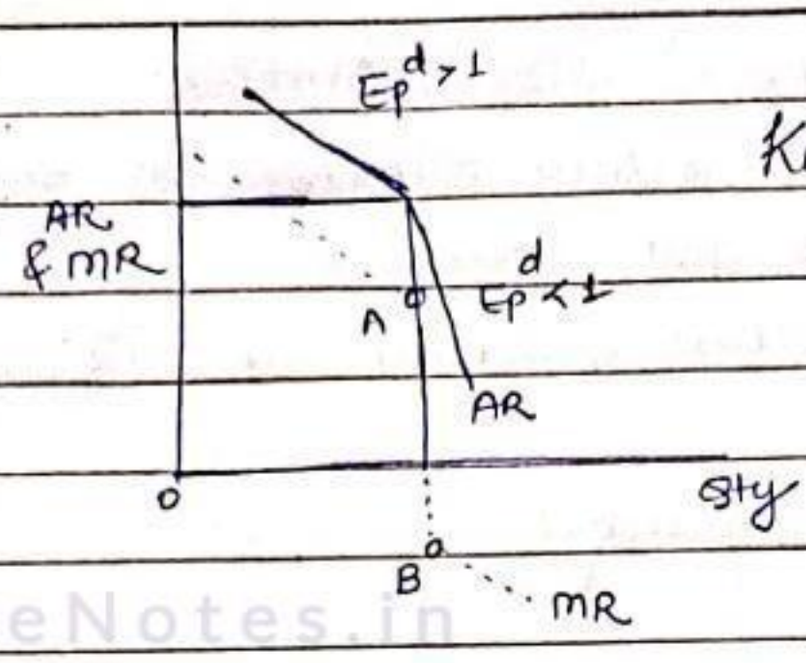
Oligopoly



Kinked demand curve.

* Selling cost

Money spent on publicity & advertisement.

Perfect comp^{n} : Not present

Monopoly : ⟶ To create awareness not competition.

very low

Monopolistic: More

Oligopoly : Max^{m} (cut throat competition)

Automobile companies

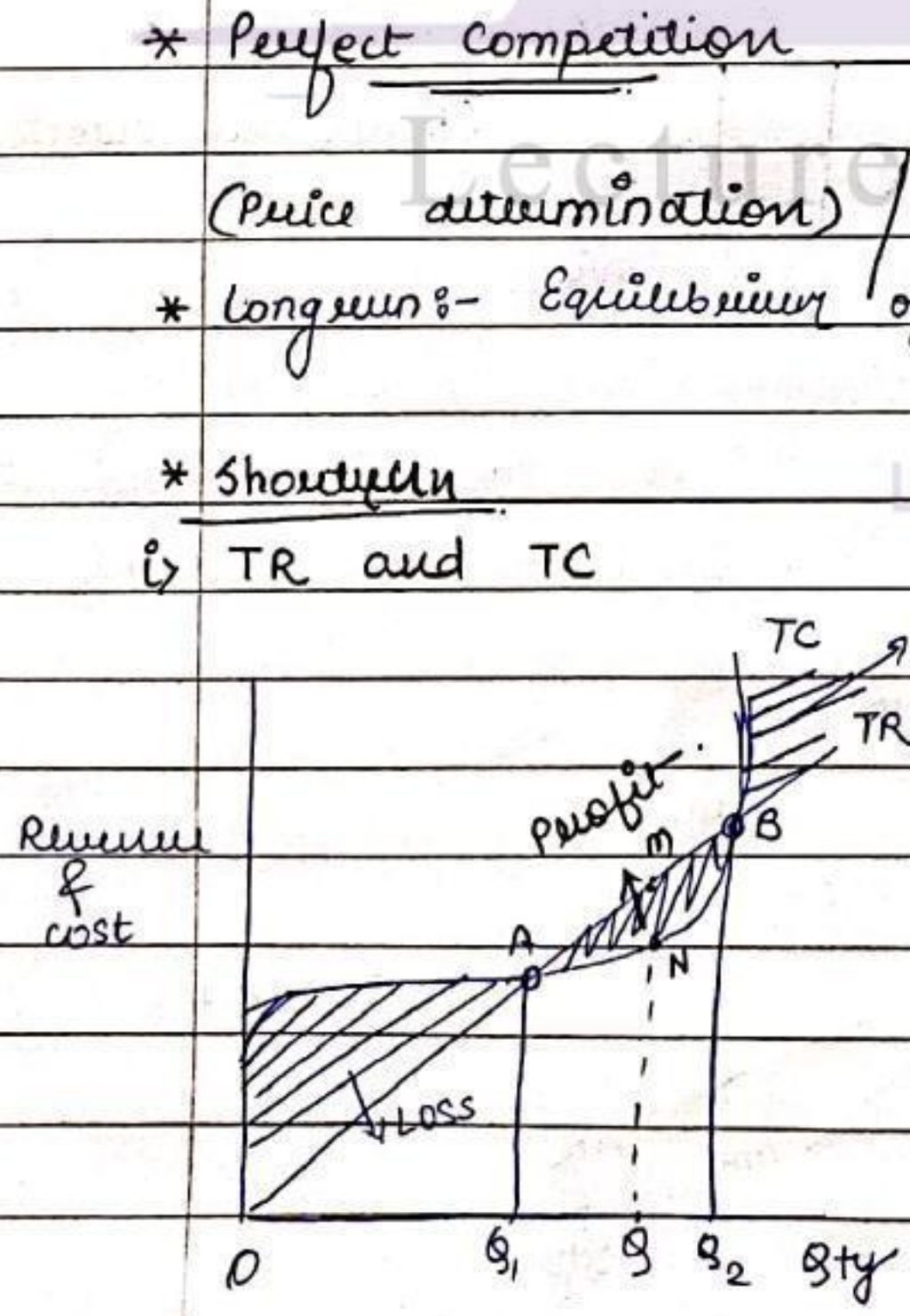
* Perfect Competition

(Price determination) / Equilibrium of price determination

* Long run :- Equilibrium of supply and demand.

* Shortrun

i) TR and TC



NO loss & no profit is break even pt.

TR = TC is break even pt.

__/__/__

i) TC > TR : loss ii) TC < TR : Profit

Price equilibrium price in Profit area.

Equilibrium = (TR-TC) max^m.

Profit

Condⁿ : Π is profit.

i) $\Pi = TR - TC$

$$\frac{d\Pi}{dQ} = 0 \quad \text{---------- (I) First order condⁿ}$$

$$\frac{d^2\Pi}{dQ^2} < 0 \quad \text{---------- (II)}$$

$\equiv$ mN (Gap)

$TR = AR \times Q$

The 2 eqⁿ need to be satisfied for equilibrium

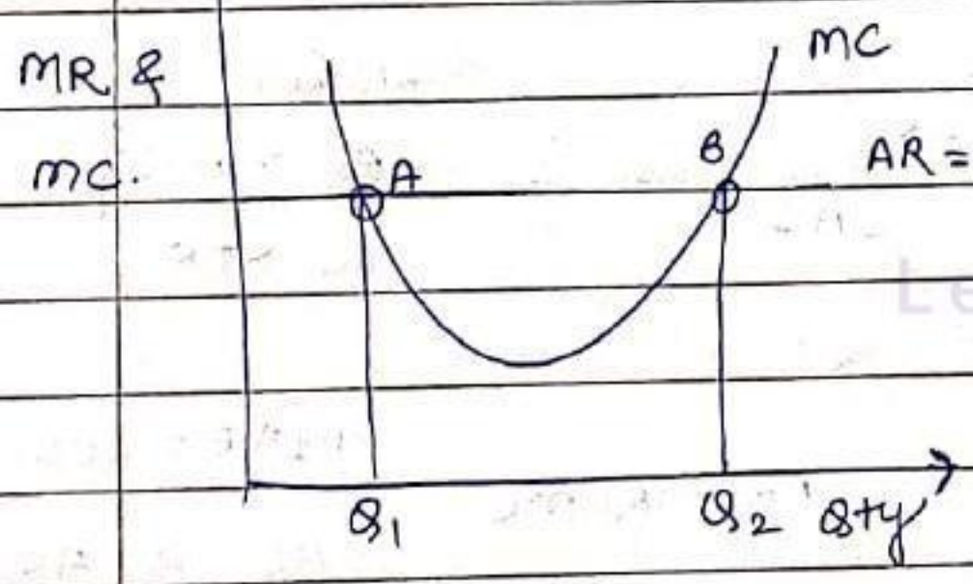
ii) MR and MC

a) MC = MR

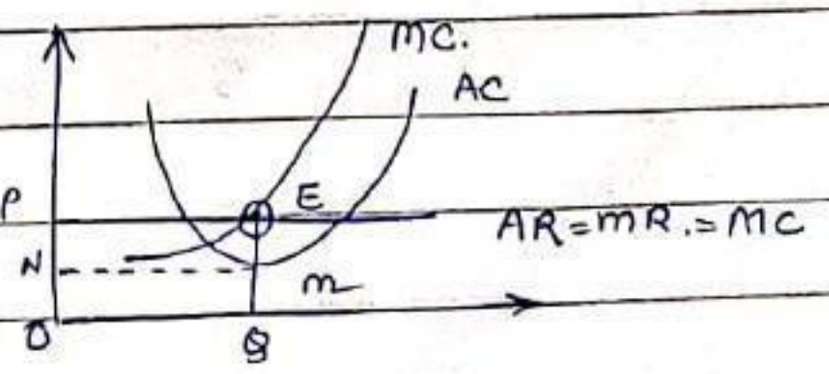
b) MC cuts MR from below. } Necessary condⁿ

Equal for all markets.

Sufficient condⁿ -



* Supernormal profit



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AR > AC & sufficient condn

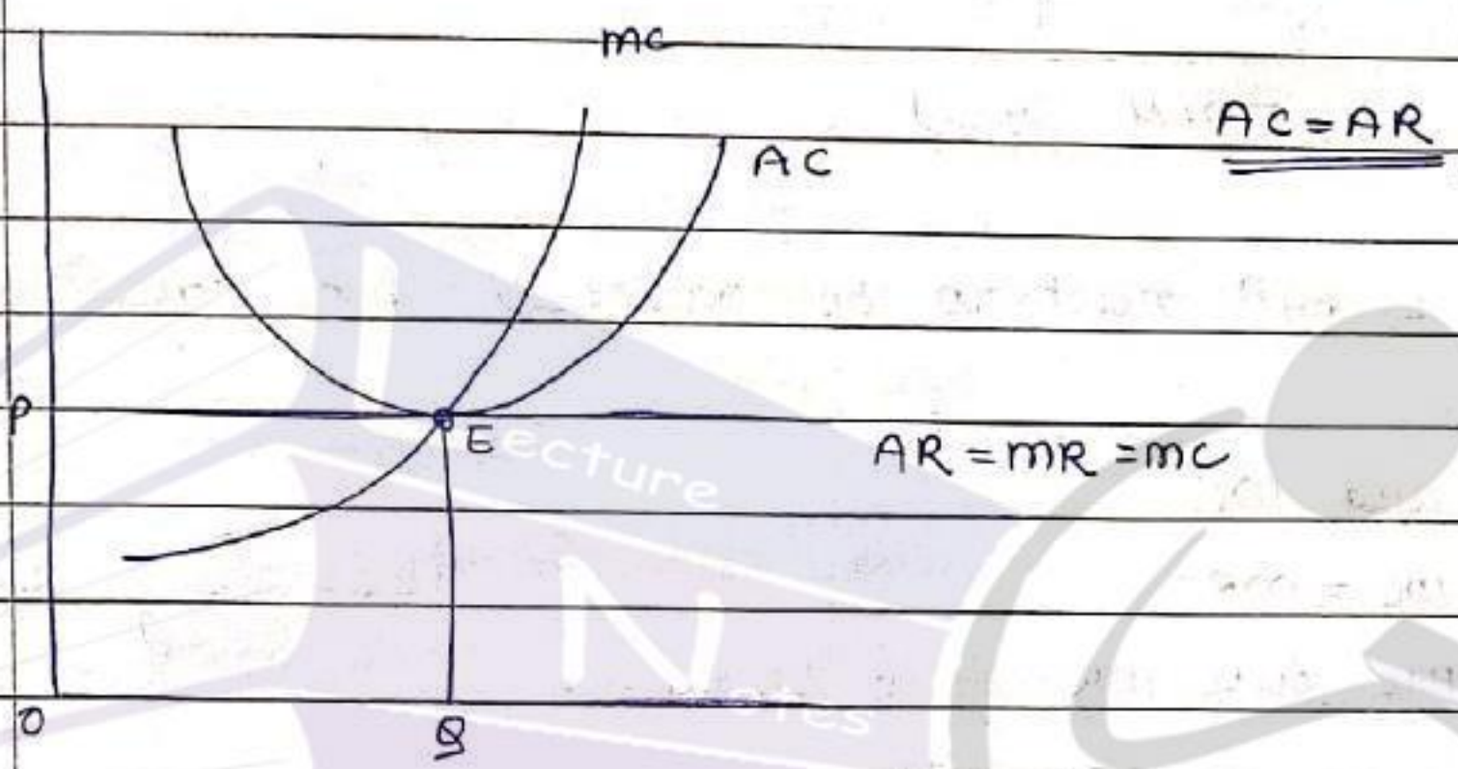
TR	>	TC
Q		Q

AR = OP AC

Supernormal profit : ꝏꝏꝏꝏ ≫ cost.

= PEMN

2) * Normal Profit



* Loss in shortrun (Perfect competition).

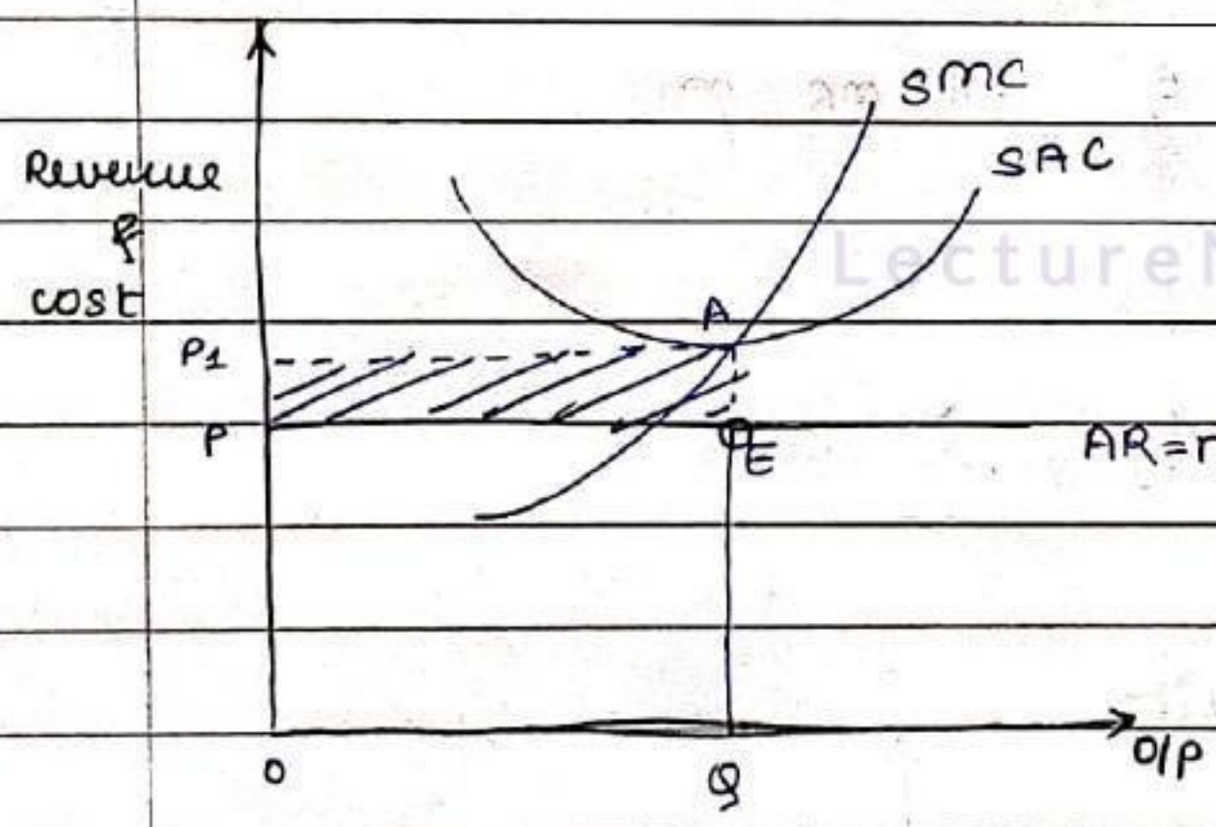
MC = MR

MC cuts MR from below.

Sufficient condn

AC > AR

TC > TR



PP1AE = loss.

AR=MR=MC

AC > AR

AQ > EQ

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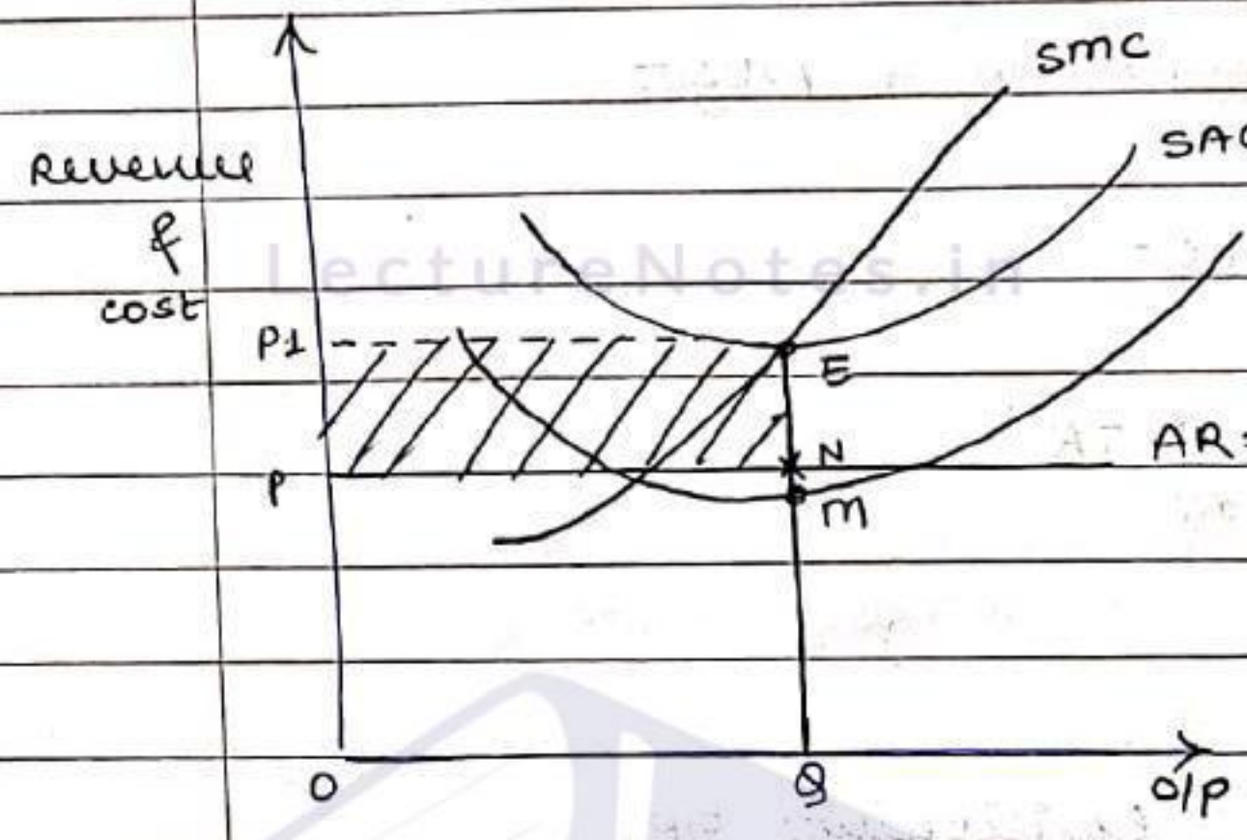
* Shutdown Point [Loss will be there]

At this point either organisation will shutdown or continue.

AVC : average variable cost.



$TC = TFC + TVC$

constant

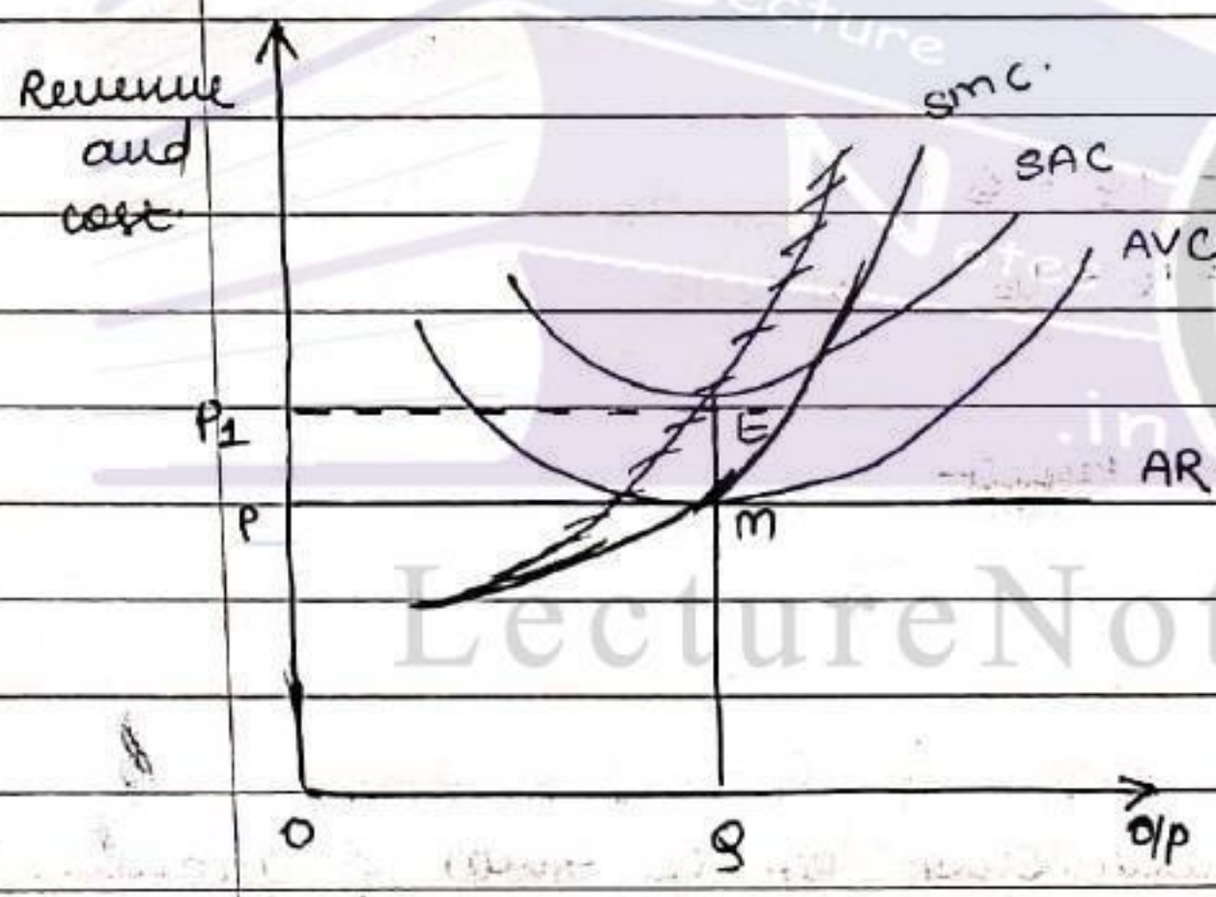
$AVC = MQ$

$AC = EQ$

$AR = NQ$

$AR > AVC$

If this is the case then producer will continue in market.



$AR = MQ$

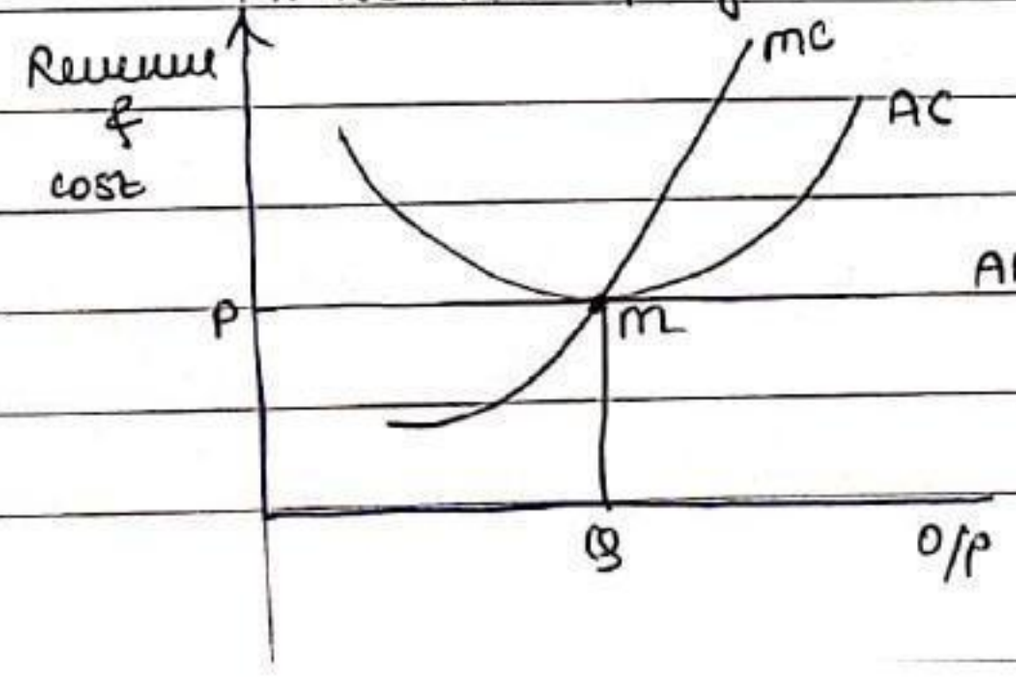
$AVC = MQ$

$AR = AVC$

Producer will shutdown the production.

* Longrun production

* Normal profit



$AC = AR$

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* In a perfectly competitive market the demand fun^{n} is given as

$R = 12Q$ #

$TC = 2 + 4Q + Q^2$

Find out equilibrium o/p & profit.

$\because R = 12Q$

$TC = 2 + 4Q + Q^2$

$\boxed{MC = MR}$.

$\frac{dTC}{dQ} = \frac{d.TR.}{dQ}$

$4 + 2Q = 12.$

$2Q = 8$

$\boxed{Q = 4}$. equilibrium o/p.

$\Pi = TR - TC$

$= 12Q - 2 - 4Q - Q^2$

$= 48 - 2 - 16 - 16$

$= 48 - 34$

$\boxed{\Pi = 14.}$ Profit.

Q. $\because R = 60Q$

$TC = 10 + 5Q^2$

Find out profit maximising o/p of firm & quantity o/p.

$TR = 60Q$; $TC = 10 + 5Q^2.$

$MC = MR.$

$\frac{d\ TC}{dQ} = \frac{d\ TR.}{dQ}$

$10Q = 60.$

$\boxed{Q = 6}$.

$TR - TC = \Pi$

__/__/____

$\frac{d\pi}{dQ} = 0$ & $\frac{d^2\pi}{dQ^2} < 0$.

$\pi = 60Q - 10 - 5Q^2$

$\frac{d\pi}{dQ} = 60 - 10Q.$

$= 60 - 10 \times 6$

$= 0.$

$\frac{d^2\pi}{dQ^2} = -10 < 0.$

∴ Profit maximising o/p : TR − TC

$60Q - 10 - 5Q^2$

$= 360 - 10 - 180$

$= 360 - 190.$

$= \underline{170}.$

* Given the shortrun cost production

$TC = 1000 + 10Q^2$

Find the shutdown point of organisation.

$TC = 1000 + 10Q^2.$ [TC = TFC + TVC]

$TVC = 10Q^2.$

Derive expression for firm's shortrun supply curve.

$AVC = \frac{TVC}{Q} = \frac{10Q^2}{Q} = 10Q.$

AR is price of the product.

$P = MC = AR = \frac{dTC}{dQ} = 20Q.$

$Q_S = \frac{P}{20}$

$\frac{d(TVC)}{dQ} = 0.$

$20Q = 0. \Rightarrow Q = 0$

__/__/____

AVC is min^m when Q=0, at this point the organisation will shutdown. (Shutdown pt.)

* | Q | ~~TVC~~ TPC | ~~TRC~~ TVC | TC | MC = TC/Q
---|---|---|---|---|---
| 0 | 100 | 0 | 100 | 100
| 1 | 100 | 50 | 150 | ~~150~~ 50
| 2 | 100 | 90 | 190 | ~~95~~ 40
| 3 | 100 | 140 | 240 | ~~80~~ 50
| [4] | 100 | 200 | 300 | ~~75~~ [60]
| 5 | 100 | 280 | 380 | ~~64~~ 80
| 6 | 100 | 380 | 480. | ~~80~~. 100

a) If price = 60, how many units will the firm produce.
b) what will be the level of profit/loss at this level of o/p?
c) will the firm operate in shortrun? [Shutdown].

P = 60 = AR.

Q = 4 for Price = 60.

* MONOPOLY 26.09.19

Shortrun (Price determination)

1. Supernormal
2. Profit
3. Loss

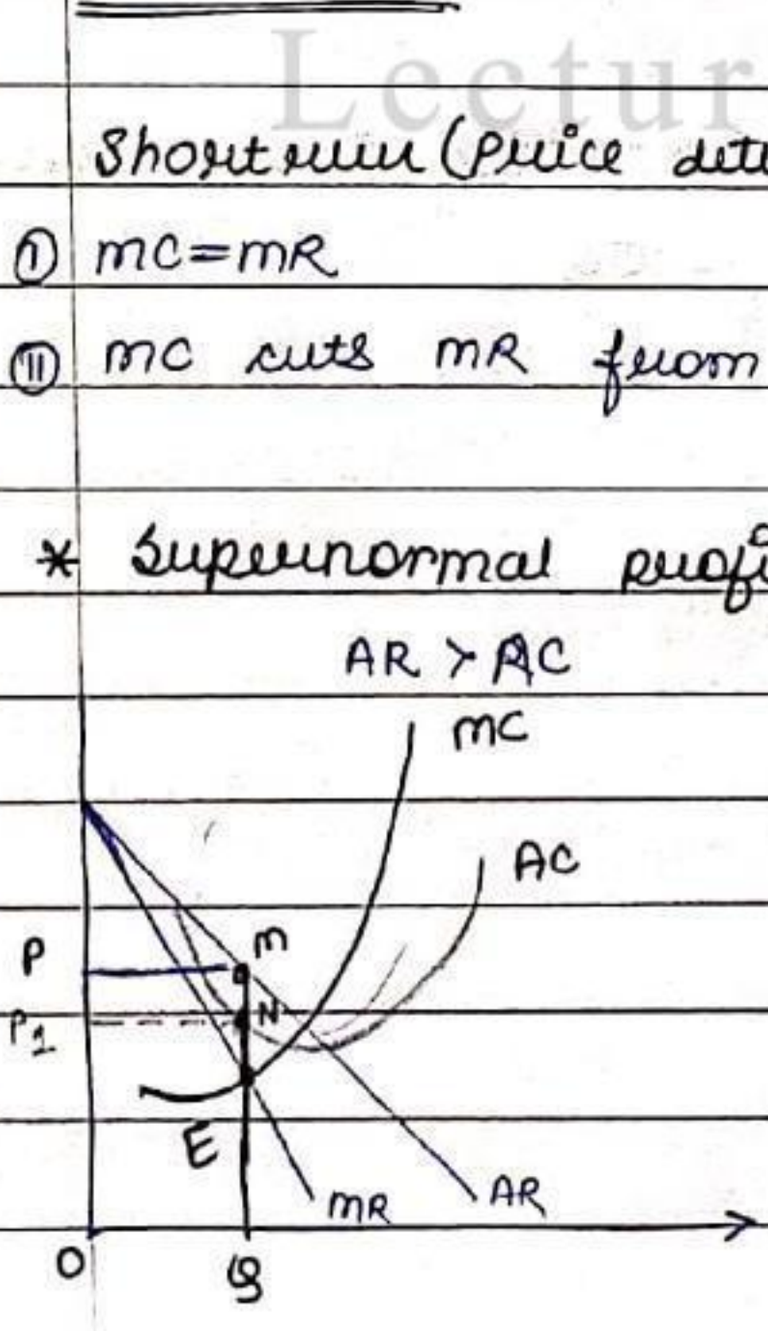
① MC = MR

② MC cuts MR from below.

* Supernormal profit

AR > AC

MQ > NQ



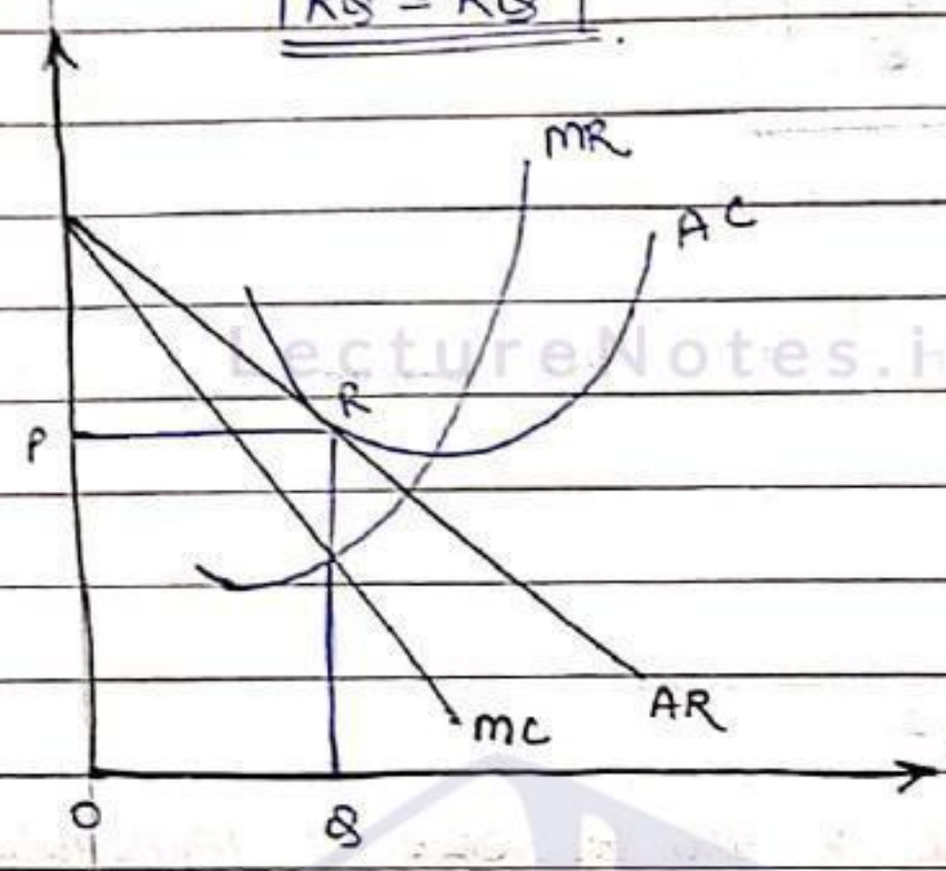
PP_1NM = Profit

Cub-Daugeas production fun^n — Linear homogeneous production fun^n.

* Normal Profit

$AR = AC$

$\boxed{RS = RS}$

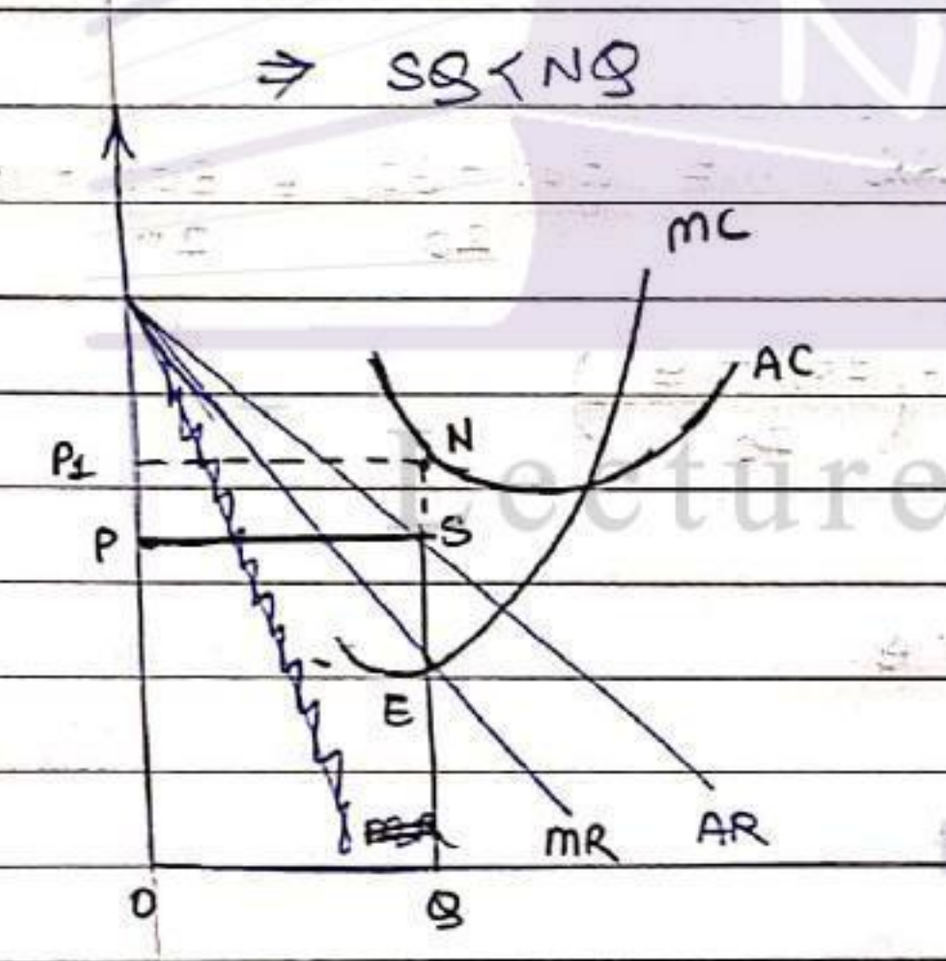


* Loss

$AR < AC$

$\Rightarrow SQ < NQ$

* In longrun production fun^n only supernormal profit occur.



$$\boxed{E_p^d = \frac{AR}{AR - MR}}$$

* Derive MC from E_p^d.

$$E_p^d = \frac{A}{A - MR}.$$

$$E_p^d(A - m) = A.$$

$$EA - A = Em.$$

$$A = \frac{Em}{E-1} \Rightarrow A = m\left(\frac{E}{E-1}\right).$$

$TC = 6 \times 60 + 0.05(3600)$

$= 360 + 180$

$= 540$

For monopoly market

$MR = MC$

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

$\because AR = MR = MC$

$\therefore$ This relation does not exist in super perfect competition market.

* $Q = 360 - 20P$

~~TR~~ $TC = 6Q + 0.05Q^2$

Find equilibrium price & qty in case of monopoly market.

$P = AR$

$TR = P \times Q.$

$Q = 360 - 20P.$

$20P = 360 - Q$

$P = \frac{360 - Q}{20} = AR = \frac{360 - 60}{20} = \frac{300}{20} = 15.$

$TR = (360 - 20P) \cdot \left(\frac{360 - Q}{20}\right)$

$MC = \frac{dTC}{dQ} = 6 + 0.1Q.$

$0 = 6 + 0.1Q.$

$Q = \frac{6}{0.1}$

$\boxed{Q = 60}$

$TR = (360 - 20 \times 15) \cdot \left(\frac{360 - 60}{20}\right)$

$= 60 \cdot 15$

$= 900$

$T = TR - TC$

$= 900 - 540$

$= 360.$

A: Two firms A and B with same capital & labour but one is more efficient than other. That efficiency is given by A.

* Suppose, Ep^d of product for a monopolistic product is -2.0. Show that Price fixed by him will be twice the mc of production Find MR/price of product.

$Ep^d = -2.0$ To Show $P = 2MC$

$$AR = m\left(\frac{E}{E-1}\right)$$

$$= mR\left(\frac{-2}{-2-1}\right)$$

$$\boxed{P = AR = mR(2)}$$

$$MR = MC$$

$$\boxed{P = 2MC}$$

* COBB DOUGLAS PRODUCTION FUN^N. 14.10.19

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

O/P = qty of labour x Qty of capital.

A: efficiency parameter.

output elasticity α: share of labour in o/p.

o/p elasticity of capital: β: share of capital in o/p.

o/p Elasticity of ~~cap~~ labour: α = % change in o/p / % change in (L)

$$= \frac{\Delta Q/Q}{\Delta L/L}$$

$$= \frac{dQ}{Q}\,\frac{L}{dL} = \frac{dQ}{dL}\cdot\frac{L}{Q}$$

Similarly $\beta = \frac{dQ}{dK} \cdot \frac{K}{Q}$.

__/__/____

It represents constant returns to scale.

It is the linear homogeneous production fun^{n}.

* Properties

1. Marginal product (MP) and Average product.

Marginal productivity of labour (MP_L): $\frac{dQ}{dL}$

$$= \frac{d}{dL}(A \cdot L^{\alpha} \cdot K^{\beta})$$

$$= A \cdot K^{\beta} \cdot \alpha \cdot L^{\alpha-1}$$

$$= \frac{(AK^{\beta} \cdot L^{\alpha})\alpha}{L}$$

$$= \frac{Q}{L} \cdot \alpha$$

$$= \left(\frac{O/P}{I/P}\right) \cdot \alpha$$

$$= AP_L \cdot \alpha$$

$$\boxed{MP_L = AP_L \cdot \alpha}$$

Similarly,

Marginal productivity of capital;

$$MP_K = AP_K \cdot \beta$$

2. MRTS = Slope of IQ

$$MRTS_{LK} = \frac{MP_L}{MP_K}$$

$$= \frac{AP_L \cdot \alpha}{AP_K \cdot \beta} = \frac{\left(\frac{Q}{L}\right)\alpha}{\left(\frac{Q}{K}\right) \cdot \beta} = \frac{\alpha}{\beta}\left(\frac{K}{L}\right)$$

$MRTS_{K,L} = \frac{\alpha}{\beta}\left(\frac{L}{K}\right)$ represent Substitution

Cost-production

Given production fun^n find cost fun^n.

$\alpha+\beta=1$ is cobb douglas production fun^n only

3. Elasticity of factor substitution : When factors are substituted the elasticity at that pt.

$$= \%\ \frac{\text{change in factor ratio}}{\%\ \text{change in MRTS.}}$$

$$= \Delta K/L \ / \ K/L \times 100$$

$$\Delta \frac{\alpha}{\beta}\left(\frac{K}{L}\right) \Big/ \frac{\alpha}{\beta}\left(\frac{K}{L}\right) \times 100$$

$$= 1.$$

In case of cobb douglas production fun^n elasticity of factor substitution always equal to 1.

4. Factor intensity

If $\frac{\alpha}{\beta}$ increases that means value of $\alpha > \beta$ [Labour intensive technique].

$\frac{\alpha}{\beta} \uparrow$: $\alpha > \beta$.

$\frac{\alpha}{\beta} \downarrow$: $\alpha < \beta$: Capital intensive technique.

5. Efficiency in production :

6. Return to scale : * $\alpha+\beta = 1$ constant return to scale.

* $\alpha+\beta > 1$ Increasing return to scale.

* $\alpha+\beta < 1$ Decreasing return to scale

* $Q_1 = A(mL)^{\alpha} \cdot (mK)^{\beta}$.

$= A \cdot L^{\alpha} \cdot K^{\beta} \cdot m^{(\alpha+\beta)}$

$Q_1 = Q \cdot m^{(\alpha+\beta)}$

if $m = 1$ the CRS.

__/__/____
15.10.19

* PRESENT WORTH.

Present worth of money.

1. Cost Dominated
   min^{m} cost
   All cost values go with
   '+' if revenue '-'

2. Revenue dominated.
   max^{m} profit/rev.
   Rev : +
   Cost : -

Present worth of an interest rate is the net equivalent amt. at present time. It represents that difference b/w net inflow (receipts) & net outflow (disbursement) made at present time with a given rate of interest.

* Industry A is planning to expand its production op^{n}. It has identified 3 different technologies. Initial outlay & annual revenue with each technology are given. Suggest the best technology implemented based on the present worth method. Assuming ROI : @20% compounded annually.

	Initial outlay	Annual revenue	Time
T1	12,00,000	4,00,000	10yr
T2	20,00,000	6,00,000	10yr
T3	18,00,000	5,00,000	10yr.

$PW_1(20\%) = -1200000 + 400000\,(P/A, i, n)$

$$P = \frac{A\,(1+i)^n - 1}{i(1+i)^n}.$$

$= -1200000 + 400000 \times 4.1925$

$= 4,77,000.$

__/__/____

$PW_2(20\%) = -20,00000 + 600000 \times 4.1925$

$= 5,15,500$

$PW_3(20\%) = 2,96,250$

PW_2 is max^m. T_2 selected.

* An engineer has 2 bids for elevator to be installed in a new building.

Bid.	Initial cost	Years	Annual opr maintenance.
A	450,000	15 yr.	27,000
B	5,40,000	15 yr.	28,5000

$PW_A(15\%) = 4,50,000 + 27000\ (P/A, i, n)$

$= 6,07,879.8$

$PW_B(15\%) = 7,06,650.9$

A bid selected for min^m cost.

* A grande company is planning to buy a fully automated cutting machine. If it is purchased under down payment cost of ~~the~~ machine is ₹16 lakh. If purchased on installment basis the company has to pay 25% of cost at time of purchase & remaining amt. in 10 ~~equi~~ annual equivalent instalment of ₹2lakh each. Suggest the best alternative for company at $i = 18\%$ compounded annually.

① ₹16,00000

② 25% of 1600000

$P = 400000$ $A = 200,000$

$i = 18\%$

$n = 10$ yr.

$$P = \frac{F}{(1+i)^n}$$ __/__/__

$PW_2(18\%) = 400000 + 200000\,(4.944)$

$= 12,98,820$

IInd alternative chosen.

* A finance company advertises 2 investment plans. In plan1 the company pays ₹ 12,00,000 after 15 yrs. for every 1000 invested now.
In plan2 for every 1000 invested the company pays ₹ 4000 at the end of ~~first~~ 10th year & 4000 at the end of 15th yr. Select the best investment plan from investors pov at $i = 12\%$ compounded annually.

(I) $P = 1000$ $i = 12\%$ $n = 15$ yr. $F = 12000$

(II) $P = 1000$ $i = 12\%$ $n = 10$ yr $F = 4000$

$n = 15$ yr $F = 4000$

$PW_1(12\%) = -1000 + 12000\,(P/F, i, n)$

$= 1192.4$

$PW_2(12\%) = -1000 + 4000\,(P/F, 12\%, 10) + 4000\,(P/F, 12\%, 15)$

$= -1000 + 4000\,(0.3220) + 4000\,(0.1827)$

$= 1018.8$

Plan 1 chosen.

* Future worth (FW) 17.10.19

$f_\omega = (F/P, i, n) = (1+i)^n$

$f_\omega = (F/A, i, n) = \left\{\frac{(1+i)^n - i}{i}\right\}$

$f_\omega = (F/G, i, n) = A = A_1 + \left\{\frac{G_1(1+i)^n - i \cdot n - 1}{i(1+i)^n - i}\right\}$.

Salvage value

__/__/____

* Consider the following 2 mutual exclusive alternatives & compare the future worth of them. 2. ROI = 18%.

Alternatives	End of year				
	0	1	2	3	4
A	-50,00000	2000000	2000000	"	"
B	-45,00000	1800000	1800000		

$FW_A(18\%) = -5000000 \cdot (F/P, 18\%, 4) + 200000\,(F/A, 18\%, 4)$

* Savage value is the future value of product at the end of life of the product, business etc.
Always FUTURE VALUE

$FW_A = -5000000 \times 1.939 + 2000000 \times 5.215$

$= 7,35,000$

$FW_B(18\%) = -4500000\,(F/P, 18\%, 4) + 1800000 \times (F/A, 18\%, 4)$

$= 6,61,500.$

Alternative A chosen [Revenue dominated].

* A person owns a corner ~~plate~~ plot. He must decide which of the several alternatives select in buying to obtain his desirable return. After much study & calculations he decides 2 best alternatives. Evaluate the alternatives based on the future worth at $i = 12\%$.

	Building gas station	Icecream stand
Initial cost	20,00,000	36,00,000
Annual property tax	80,000	1,50,000

__/__/____

Annual Income	8,00,000	9,80,000
Time	20 yr.	20 yr.
Salvage value	0	0.

Net income = Annual property tax - Annual income.

(A)

P : Initial cost

(12%) PW_1 = $-20,00,000\,(F/P, i, n) + 7,20,000\,(F/A, i, n)$

= 3,25,85,440

PW_2 (12%) = 2,50,77,560

Building gas station is chosen by the person [Revenue dominated].

* A small business with an initial outlay of ₹12,000 yeids ₹10,000 during the first year of its opn & the yield increases by ₹1000 from its second year upto 10th yr. of opn. At the end of the life of the business the salvage value is 0. Find the present worth of the busines at an interest rate of 18% compounded annually.

P = -12000 A_1 = 10000 G = 1000 i = 18% n = 10 yr.

$$PW(18\%) = -12000 + \{10000 + 1000\,(P/G, i, n)\} \times (P/A, i, n)$$

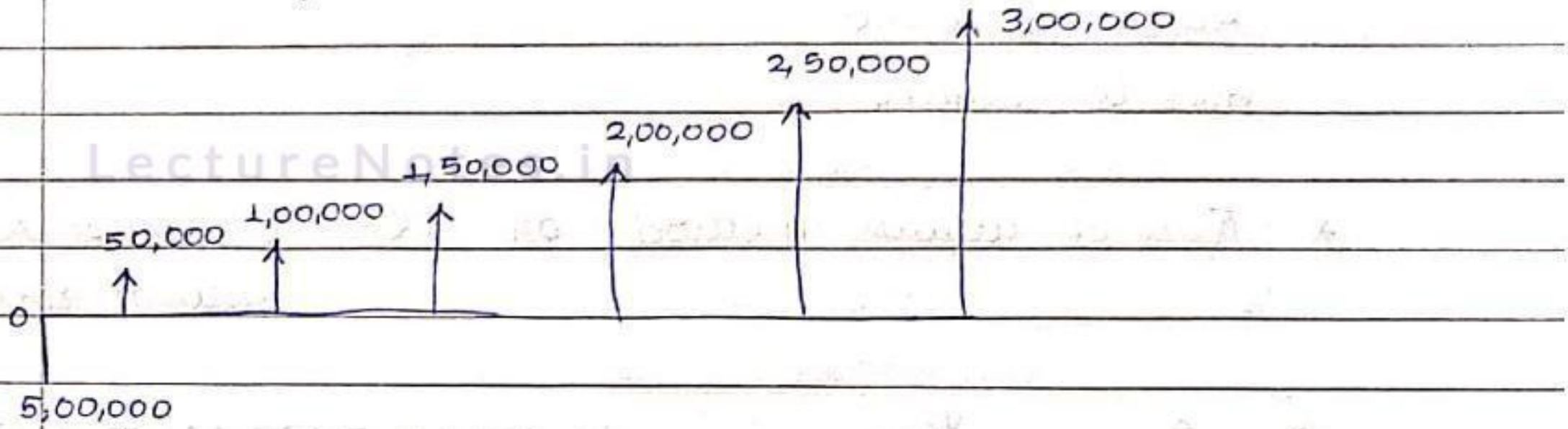
$$= -12,000 + \underbrace{\left\{10000 + G\,\frac{(1+i)^n - in - 1}{i(1+i)^n - i}\right\}}_{A} \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

__/__/__

$PW(18\%) = -12000 + \{10000 + 1000 \times 3.1936\} * 4.4941$

$= \underline{47293.36}$.

* Find out future worth at $i = 8\%$.



$FW(8\%) = -5,00,000 + \{50,000 + 50,000\,(P/G, i, n)\} * (F/A, i, n)$

$= -5,00,000 + \left\{50,000 + 50,000 \left(\frac{(1+i)^n - in - 1}{i(1+i)^n - 1}\right)\right\} * (F/A, i, n)$

$= 5,71,596.93$

* Annual worth, A(w) 21.10.19

$A(w) = A\,(A/P, i, n) + A + A\,(A/F, i, n)$

*	M	Downpay	Yearly installment
	1	5,00,000	2,00,000
	2	4,00,000	3,00,000
	3	6,00,000	1,50,000

$i = 20\%$. $n = 15$ yr.

__/__/____

* Cost dominated

$AW_1 = 5,00,000(A/P, i, n) + 2,00,000$

$= 306941.05$

$AW_2 = 385560$

$AW_3 = 278340$

AW_3 is selected.

* Rate of return method. or IRR (Interest rate return method).

*	P	Year
	-1,00,000	0
	30,000	1
	30,000	2
	"	3
	"	4
	"	5

$PW(10\%) = -1,00,000 + 30,000(P/A, i^\circ, n)$.

$= 13,724$

$PW(15\%) = -1,00,000 + 30,000\ (P/A, i^\circ, n)$

$= 566$

$PW(18\%) = -1,00,000 + 30000(P/A, i^\circ, n)$

$= -6184$

$(15\%)\ i = 15\% + \frac{566}{566 - (-6184)} \times (18\% - 15\%)$

$= 15.25\%$

* Depreciation

D_t = Depreciation ; B_t = Book value ; P = Initial cost asset

n = Time ; F = salvage

$D_t = (P - F)/n$

$B_t = B_{t-1} - D_t$

Shivangi

1. Straight line method

$P = 1{,}00{,}000$

$n = 8$ yr.

$F = 20{,}000$

$$D_t = \frac{(P-F)}{n}$$

$$= \frac{80{,}000}{8} = 10000$$

$$B_t = P - \left[t \times \frac{(P-F)}{n} \right]$$

for $B_4 = 100000 - 4 \times \frac{(100000 - 20000)}{8}$

$= 99.996 \times 10000$

$= 60{,}000$.

$B_t = 1{,}00{,}000 - 10{,}000$

$= 90000$

y	D_t	B_t
0	-	1,00,000
1	10000	90000
2	"	80,000
3	"	70,000
	"	
	"	
	"	
8	"	

2. Declining Balance method.

$B_t = B_{t-1} - D_t$ k: fix %

$D_t = k \times B_{t-1}$.

* $P = 1{,}00{,}000$ $F = 20{,}000$ $k = 0.2$ $n = 8$ yr.

Year	D_t	B_t
0	-	1100,000
1	20,000	80,000
2	16000	64,000
3	12800	51200
4	10240	40960
5	8192	32768

__/__/____

6	6553.3	26214.4
7	5242.8	20971.52
8	4194.3	16777.2

OR

$D_t = \cancel{k(1-k)^k}\ k(1-k)^{t-1} \times P$

$B_t = (1-k)^t \times P$

B_5 , D_5

$B_5 = (1-0.2)^5 \times 100000$

$= 32768.$

$D_5 = 0.2(0.8)^4 \times 100000$

$= 8192$

3. Sum of the year method

If $n = 8$

$1+2+3+--+8 = \frac{n(n+1)}{2} = 36.$

Rate of depreciation : 1 yr : $\frac{8}{36}$; 2 yr = $\frac{7}{36}$; 3 yr = $\frac{6}{36}$

-- 8 yr = $\frac{1}{36}$

D_t = Rate of depreciation $(P-F)$

$B_t = B_{t-1} - D_t$

$D_1 = \frac{8}{36}(100000 - 20000) = 17,777.7.$

$D_2 = \frac{7}{36}(80000) = 15555.55$

$D_3 = \frac{6}{63}(80,000) = 13333.33.$

$D_4 = \frac{5}{36} \times 80000. = 11,111.11$

$D_5 = \frac{4}{36} \times 80000 = 8888.88.$

$D_6 = \frac{3}{36} \times 80000 = 6,666.66$

$D_7 = \frac{2}{36} \times 80000 = 4444.44$

$D_8 = \frac{80000}{36} = 2222.22$

$Bt_1 = 82222.2$

$B_2 = 66,666.8$

Direct formula:

$$D_t = \frac{n-t+1}{n(n+1)/2} (P-F)$$

$$B_t = (P-F) \cdot \frac{(n-t)}{n} \cdot \frac{(n-t+1)}{n+1} + F.$$

4. Sinking fund method. [Storing money for future not depreciation].

* Calculate A = depreciation.

Depreciation of 1st yr = $(P-F)\ [A/F, i, n]$. $i = 12\%$.

$$= 80000 \left[\frac{i}{(1+i)^n - 1} \right].$$

$= 6504$

__/__/____

$B_{t-1} - D_t$

Year	D_t (71%)	D_t (net)	B_t
0	6504		100000
1	6504		93496
2	7284		86211.5
3	8158	D_t (Net	78052.9
4	9137		68915.25
5	10234.17		58612.08
6	11462.27		47218.8
7	12837.74		34381.07
8	14378.27		20,002.8

$D_2 = 6504 + (6504 \times 12\%)$

$= 7284 \quad +6504$

$D_3 = 6504 + (7284 \times 12\%)$

:

:

Year	Interest rate	D^e_t	B_t
0			
1		6504	
2	6504 × 12% = 780.4	6504 + 780.4 = 7284.4	
3	7284.4 × 12% = 874.1	7284.4 + 874.1 = 8158	
4	8158 × 12.1% = 978.9	8158 + 978.9 = 9137	

Direct formula

$D_t = (P-F)(A/F, i, n) \times \{F/P, i, (t-1)\}$

$B_t = P - (P-F)(A/F, i, n)(F/A, i, n)$.

__/__/__

29.10.19

* Public Alternative (Benefit cost Ratio).

$\frac{\text{Benefit}}{\text{cost}} > 1$ Accepted

$\frac{\text{Benefit}}{\text{cost}} \leq 1$ Rejected.

$$\text{Benefit cost} = \frac{B_P}{P+C_P} = \frac{B_F}{P_F+C_F} = \frac{B_A}{P_A+C_A}.$$

B)

Future worth of total benefit : B_F

Present worth of ——"—— : B_P.

B_A:

P: Initial investment/cost

P_F: Future worth of initial cost

P_A: Annual worth of initial cost.

C_P: ~~Yearly cost of opⁿ~~ Present worth of cost

C_A: Annual worth of ~~initi~~ yearly cost.

C_F: future worth of yearly cost.

* Initial cost (P) = 40,00,000

Annual opⁿ & maintenance cost = 1,50,000.

Equal increament in fuel saving = 50,000

life : 15 yr.

i : 12%

The value of fuel saving during the construction of bridge is 6 lakhs in the first yr. It increases by 50,000 every year till the end of life of bridge.

__/__/____

Check the project is justified or not based on benefit cost ratio.

Cost : $P + A(P/A, i, n)$

$$40,00,000 + 150,000 \left\{ \frac{(1+i)^n - 1}{(1+i)^n \cdot i} \right\}$$

$= 5021635$

= Present worth of cost.

$P_w(\text{Benefit}) = A_1 + G(A/G, i, n) \times (P/A, i, n)$

$= 6,00,000 + 50,000(4.9803) \times \left(\frac{(1+i)^n - 1}{(1+i)^n \cdot i} \right)$

$= 5782556$

$\frac{\text{Benefit}}{\text{cost}} = \frac{5782556}{5021635} > 1 \Rightarrow$ Govt. will go with the project.

* Initial cost = 8,00,00,000

Annual power sale = 60,00,000

Annual flood control saving = 30,00,000

" irrigation benefit = 50,00,000

" recreation benefit = 20,00,000

Annual operational & maintenance cost = 30,00,000.

life = 50 yr.

$i = 12\%$

Total benefit = 30,00,000 + 50,00,000 + 20,00,000

= 1,00,00,000

$P_w(\text{Benefit}) = A(P/A, i, n)$.

$= 1,00,00,000 \ (P/A, i, n) = 83045000.$

$P_w(\text{cost}) = 8,00,00,000 + A(P/A, i, n) - 60,00,000(P/A, i, n)$.

$= 5086500.$

__/__/____

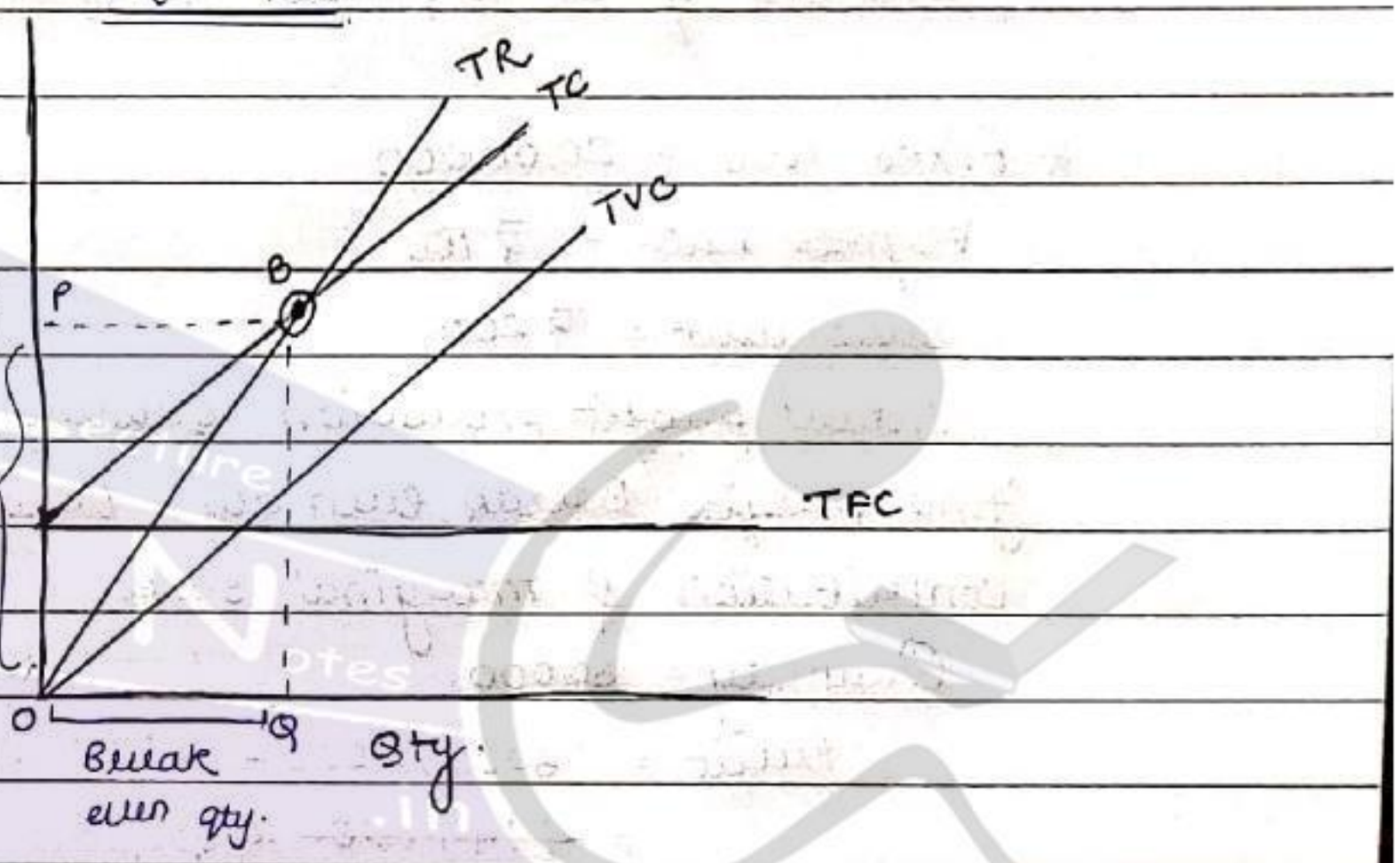
Benefit / cost > 1

Qout. will go with the project.

* BREAK EVEN ANALYSIS. 31.10.19

The point of no profit or no loss. Here revenue = total cost.

TR = TC



Company will survive in market if it is at break even point.

It is the margin b/w loss & profit.

S = Selling price/unit = Average revenue

V = Variable cost

F = fix cost

Q = Qty of production

Profit = TR - TC

= Q × selling price/unit − (TFC + TVC)

1. Break even qty = FC / (selling price − Variable cost) = F / (S − V)

__/__/____

2. Break even sales/revenue = $\frac{FC}{\text{selling price} - VC} \times S$

= Break even qty x S.

3. Contribution = sales - TVC

4. Marginal safety = Actual sale - Break even sale.
[upward of it is profit & downside loss].

* Fixed cost = 20,00,000

VC/~~pro~~ unit = ₹100

Sales/unit = ₹200

Actual ~~profit~~ production Quantity = 60,000

Find profit, Break even qty., break even sales, contribution & marginal sales.

Quantity = 60,000.

Profit = 60000 x 200 - [20,00,000 + 100 x 60000]

= ~~9999900~~ 40,00,000

Break even qty = $\frac{20,00,000}{200 - (100)\times\text{~~60000~~}}$

= $\frac{2000000}{\text{~~100~~}}$

= 20,000.

Break even sales = 20,000 x 200

= 40,00,000

Contribution = Total sales - Total VC

= 200 x 60,000 - 100 x 60000

= 6000000

$1,20,00,000 - 40,00,000$

$= 80,00,000$

Marginal safety = Total sale − BE sale

$= 60,000 \times 200 - 40,00,000 \times 60,000$

~~$= 120000000 - 40,00,000 = 80,00,000$~~

~~$= 80,00,000$~~ ~~$1,9,60,000$~~

Marginal safety = $\frac{\text{Profit}}{\text{contribution}} \times$ Sales.

$= \frac{40,00,000}{60,00,000} \times \frac{2}{120000000}$

$= 8000000$

* Profit/Volume Ratio (P/V).

V or Quantity

① $\frac{P}{V} = \frac{\text{Contribution}}{\text{Sales}}$

$= \frac{\text{Sales} - VC}{\text{Sales.}}$

Qty

② BE point = $\frac{Fc}{P/V \text{ ratio}}$

③ Marginal safety = $\frac{\text{Profit}}{P/V \text{ ratio}}$

* Total sales = 1,20,000.

FC = 25000

VC = 45000

Find contribution, profit, Break even pt, & marginal safety.

Profit = 1,20,000 − (25000 + 45000)

= 1,20,000 − 70,000

= 50,000

Contribution = Sales − VC

= 1,20,000 − 45000

= 75000