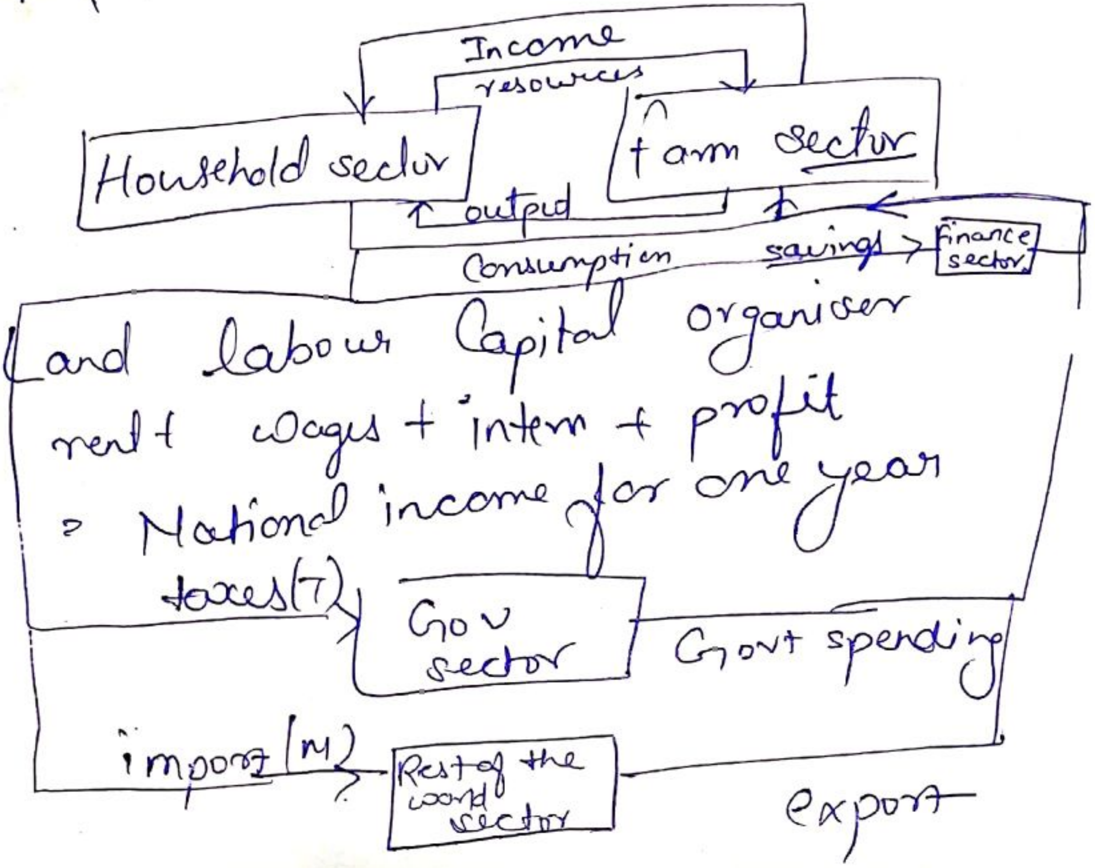
NATIONAL INCOME CONCEPTS :



$S + T + M = I + G + X$

Leakages Ingection

> then recession

< boom or prosperity

Gross Domestic Product

GDP at market price - Nominal GDP

It refers to the ~~total~~ market value of the final goods and services produced in the country in one year calculated at market price.

$GDP_{mp} = C + I + G + (X - M)$

Gross National Product at market price

$GNP = C + I + G + (X - M) + NFIA$

$GNP = GDP + NFIA$ (Net factor income from abroad)

It refers to the total market value of the final goods and services produced in the country in one year including the net factor income from abroad which refers to the net foreign income after deducting the foreign remmitances living the country.

Net national product at market price

$GNP = $ Depreciation..

It refers to the total market value of the final goods & services produced in the country in one year including the net factor income from abroad after deducting the depreciation charges which the economy has to spend on the maintance of the peculiarly invested capitals asset.

NNP = Undervied + subsidies + taxes.

It refers to the final volume of the goods and services produced in country in one year (after including NIFA and subsidised and deducting at

Demand Analysis

Demand in an economic sense refers to

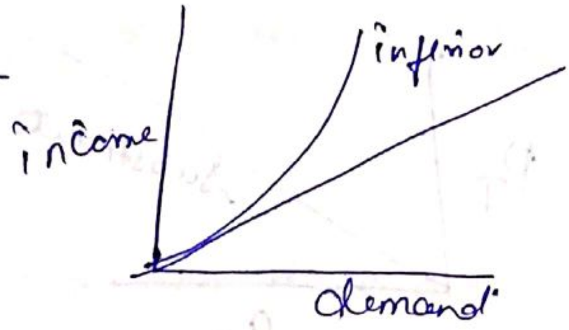
(i) Desire for the commodity
(ii) Willingness to pay for the commodity
(iii) The ability to pay for the commodity.

Factors affecting demand

(1) Price :- Q_d = Quantity demanded varies inversely with the price, other factors remaining constant.

$\frac{dQ_x}{dP_x}$ - negative slope.

② Income :-



If the quantity demanded of one commodity varies directly with the income of the consumer it is said to be a normal good while an negative relation with income shows that the product is inferior for the consumer.

③ Price of related commodities :-

Commodity : X & Y

Price : P_x & P_y per unit

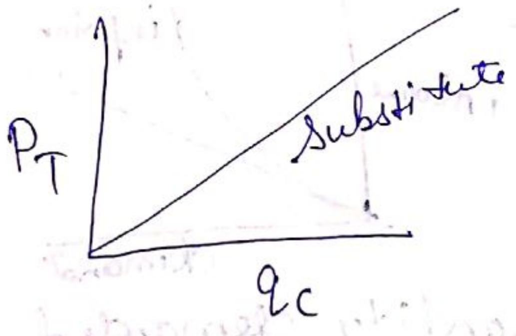
quantity consumed : Q_x & Q_y.

Joint products / Complementary goods.

Two commodity are said to be related if the quantity demanded of one product varies with the change in price of the other commodities.

$$\frac{dQ_x}{dQ_y} > 0 \Rightarrow \text{Substitute}$$

$$< 0 \Rightarrow \text{Joint}$$



4. Taste and Preferences (Increase)
5. Advertisements (Ad) Increase
6. Future Exceptations of price and income (gold) (Bull & Bear)

Demand f^n = f (P_x, P_y, Y, Ep ...)

Law of Demand

It states that all other factors assumed constant, there will exist an inverse relationship between quantity and price.

Assumptions:-

1. The consumer is assumed to be rational.
2. Their is no advirtisement
3. There is no change in income and price of related commodities.

The commodity x demand $\Rightarrow Q_x$

$\sum^{n} D_{i}(P_x)$

D_i = Demand of the i^{th} consumer ($i = 1 .. n$)

Quantity demanded by consumer.

Price	A	B	C	D	$Q_x = \sum B_i(P)$
10	1	0	3	0	4
9	3	1	6	4	14
8	7	2	9	7	25
7	11	4	12	10	37
6	13	6	14	12	45

Classification of goods

Normal, inferior, Giffen.

Price effect

Income effect (IE)

Substitution effect (SE)

$$\frac{dQ_x}{dR_I} + \frac{\partial Q_x}{\partial P_x} = PE$$

Price effect :- It refers to the overall change in quantity demanded of a product due to a change in price.

* The income effect refers to that part of the price effect which will measure the quantity variation in the product following the change in the real income or purchasing power of the consumer due to the change in price - $\frac{\partial Q_x}{\partial RI}$.

* Substitution effect :- It measure that part of price effect which show the quantity variation due to a change in the position of the commodity relative to other similar commodities following the price level.

Fall of price of commodity effect.

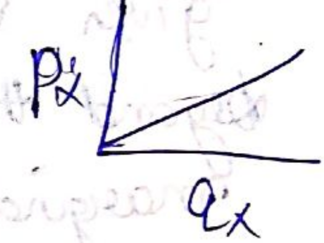
Normal :- SE (negative) ↑ = PE↑
IE (+ve) ↑

Inferior :- SE (-ve) ↑ = PE↑ (-SE > -IE)
cheap, pos
IE (-ve)↓

Griffen : SE (-ve) ↑ + IE (-ve)↓ = PE↓
(-IE > -SE)

Inferior: In this case the law of demand still operates because the negative substitution effect is stronger than the negative income effect.

Giffen: goods are those category of inferior group with the very strong (-ve) income effect which outweighs the negative substitution effect breaking down the inverse relationship between quantity and price.



Rise in price of comm x

Normal:- SE (-ve) ↓ ⇒ PE ↓
IE (+ve) ↓

$\frac{dq_x \uparrow}{dP_x \downarrow}$

Inferior:- SE (-ve) ↓ ⇒ PE ↓ (-SE > -IE)
IE (-ve) ↓

$\frac{dq_x \downarrow}{dRI \downarrow}$

Giffen:- SE (-ve) ↓ ⇒ PE ↑ (-IE > -SE)
(Nokia) IE (-ve) ↑

Reasons for downward slope of demand curve :-

1. Diminishing Marginal Utility
Change in utility (Satisfaction how much)

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

Utility refers to the want satisfying power of a commodity. As a consumer is given successive units of the same product beyond the range of consumption the marginal utility he receives starts decreasing. At a higher level of consumption, where the utility is low, only a lower price can induce the consumer to purchase more of the product and vice versa.

Substitution effect :- When the price of a commodity falls it becomes cheaper relative to other similar commodities and so more of it will be purchased and vice-versa.

Income effect :- When the price of a commodity falls the real income of the consumer increases and so more of the normal commodities will be purchase and vice versa.

New consumers:
Due to fall in price, others also get attracted.

Exceptions to the law of demand.

Giffen goods - they represent extremely inferior good with a very strong -ve income effect which outweighs the negative substitution effect breaking down the inverse relationship between quantity and price

Cases of interdependence of demand:-

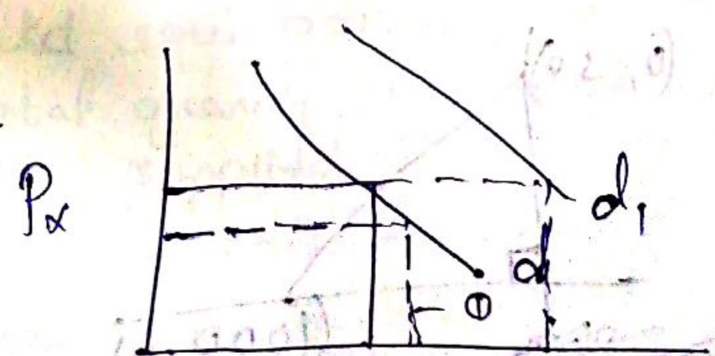
1 Bandwagon effect
2 Snob effect (exclusive)
3 Veblen effect (status effect)

Future Expectations

Change in fashion

Ignorance (mol bhav)

Ques



dem.
Inc ↑

Q:1

~~$X = 9P_x - 0.2P_y$~~

Substi $\frac{\partial Q_x}{\partial P_y} > 0 \Rightarrow$ Subs

< 0 Joint

$X = 9P_x - 0.2P_y$

$\frac{\partial x}{\partial P_y} = 9\frac{\partial P_x}{\partial P_y} - 0.2$

$\frac{\partial x}{\partial P_y} = 0.7\, P_y^{-0.7} P_x^{-0.2} P_2^{-0.1} > 0$

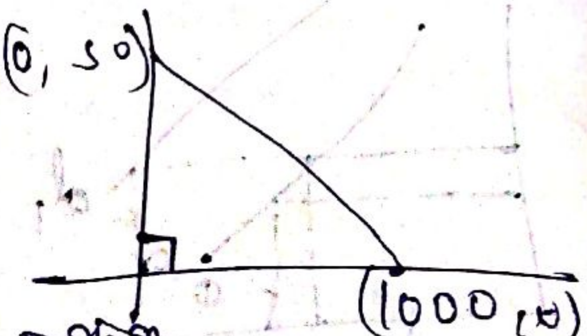
compliment

$X = 9P_x^{-0.2} P_y^{0.3} P_2^{-0.1}$

$\frac{\partial x}{\partial P_x} = -0.18\, P_x^{-0.3} P_y^{0.3} P_2^{-0.1} < 0$

law of demand is satisfied

$\frac{\partial x}{\partial P_2} < 0$, compliments.



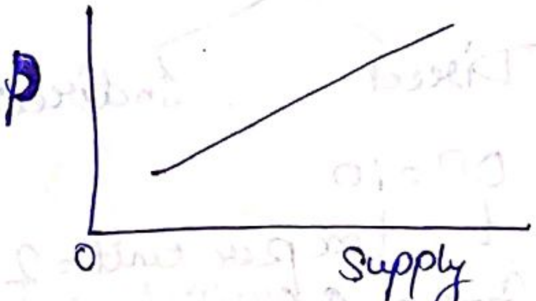
~~$\frac{y_2 - y_1}{x_2 - x_1} = m = \frac{y - y_1}{x - x_1}$~~

~~$y - y_1 = m(x - x_1)$~~ $y = 50 - \frac{x}{20}$

Supply analysis

Supply is a function of price

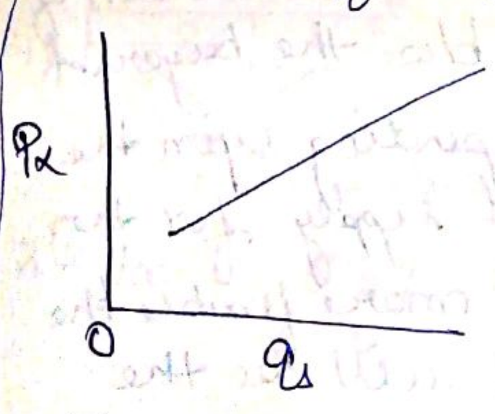
$S = f(\text{Price})$

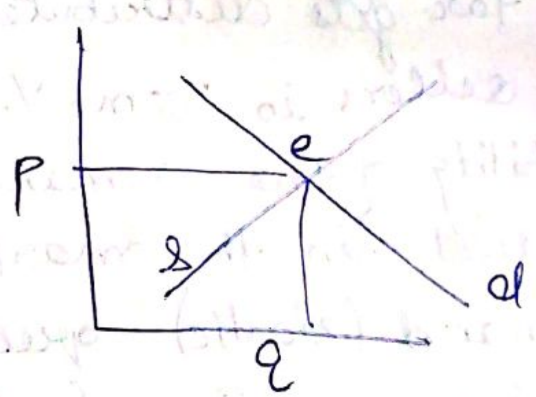


Foreign Exchange Market Equilibrium

Supply analysis

Factors affecting Supply (Write short notes)



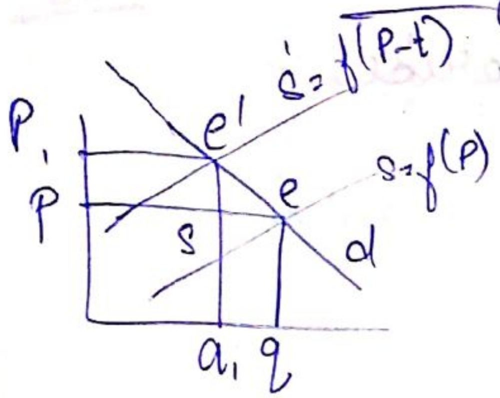


Market equilibrium refers to the point where the total quantity demanded equalises the quantity supplied thereby determining the equilibrium price & quantity. Demand = supply

1. Price of commodity.
2. Price of related commodities
3. State of technology
4. Factor availability & their prices
5. Time

Before eq $S > D$
After eq $D > S$

Market eq with Taxes & Subsidies



Taxes

Direct — Indirect (GST)

$OP = 10$

t = tax per unit = 2

Govt = $e_1 G$

Buyer = $e_1 H$

Seller = HG

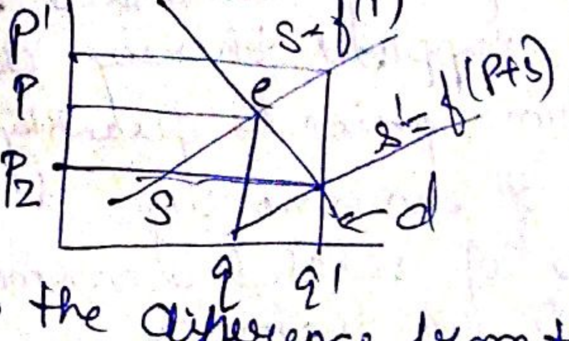
Depends on if product is elastic / inelastic

elastic ↓ TV, fridge

inelastic ↓ petrol, salt

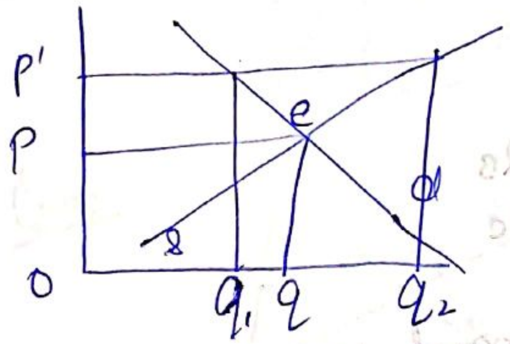
In case of indirect taxes the total burden of the tax gets distributed b/w the buyers & the sellers in some % depending upon the flexibility of the demand & supply for the product in the market more flexible the demand (elastic), greater will be the burden on seller & vice versa.

② Subsidies.



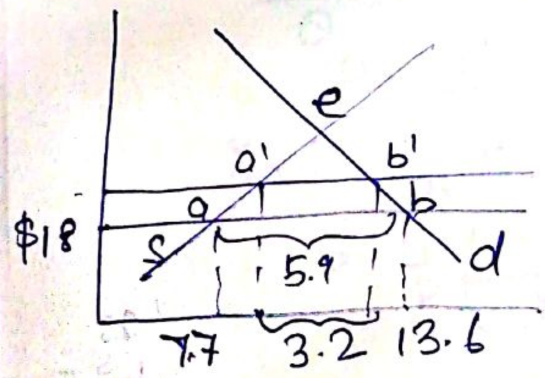
It refers to the difference from the market price which is paid by the govt ~~which~~ to encourage the production & consumption of the product in the market.

3. Maximum support price



Dem = Oq1
supply = Oq2
surplus = q1q2

Ques Total demand - 13.6 million barrels/day
7.7 M bpd - US produces
Rest imported
Avg price of oil = $18 → below the eq price



① Tax = $33\frac{1}{3}$ % on $18
$= \frac{100}{3 \times 100} \times 18 = \$6$

② b' = 12.2 million, a' = 9.0 million
Revenue = P×Q = 3.2M × 6 = 19.2M
- Tariff = tax on imported goods
Supply increased, import decreased.

Ques 4 consumers
A B C

A: $P = 85 - 0.5Q_A$
B: $P = 50 - 0.25Q_B$
C: $P = 40 - 2.00 Q_C$

i) find the market demand function.

$Q_d = Q_A + Q_B + Q_C$

$P = 35 - 0.5 Q_A$

$Q_A = \frac{P - 35}{0.5}$

$Q_B = \frac{P - 50}{0.25}$

$Q_C = \frac{P - 40}{2}$

$Q_A + Q_B + Q_C = \frac{P-35}{0.5} + \frac{P-50}{0.25} + \frac{P-40}{2}$

$= \frac{\quad}{0.25}$

$Q_d = 290 - 6.5P$

$Q_d = Q_s = 40 + 3.5P$ $\quad Q_s =$ given

$290 - 6.5 = 40 + 3.5P$

$\boxed{P = 25}$

.125
0.25
4
29

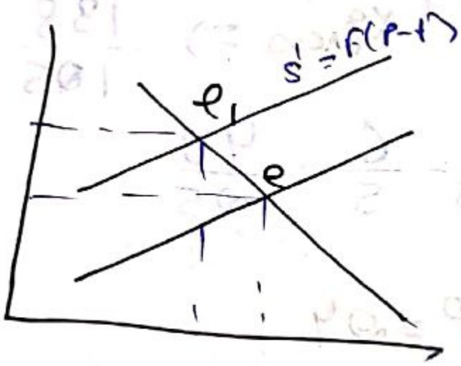
ii) $Q_d = 290 - 6.5(25)$

$= 290 - 162.5$

$\boxed{Q_d = 127.5}$

$$\begin{array}{r} 65 \\ \times 25 \\ \hline 325 \\ 1300 \\ \hline 162.5 \end{array} \qquad \begin{array}{r} 290.0 \\ -162.5 \\ \hline 127.5 \end{array}$$

Ques



$x_d = \frac{1}{2}(5-P)$

$x_s = 2P-3$

i) $x_d = x_s$

$\frac{5-P}{2} = 2P-3$

$P = \frac{11}{5}$

$x_d = \frac{1}{2}\left(5 - \frac{11}{5}\right)$

$= \frac{1}{\cancel{2}}\left(\frac{\cancel{14}\,7}{5}\right) = \frac{7}{5}$

$$\begin{array}{r} 25 \\ -11 \\ \hline 14 \end{array}$$

ii) $x_s = 2P-3$

$x_s' = 2\left(P - \frac{6}{5}\right) - 3$

$\frac{5-P}{2} = 2P - \frac{12}{5} - 3$

$\frac{5}{2} - \frac{P}{2} = 2P - \frac{12}{5} - 3$

$\frac{5}{2} + \frac{12}{5} + 3 = \frac{P}{2} + 2P$

$\frac{25+24+30}{10} = \frac{P+4P}{2}$

$\frac{79}{\cancel{10}\,5} = \frac{5P}{2} \Rightarrow \boxed{P' = \frac{79}{25}}$

$$\begin{array}{r} 25 \\ 30 \\ 24 \\ \hline 79 \end{array}$$

$$25\overline{)52}\;2.08 \quad \begin{array}{r} 50 \\ \hline 200 \end{array}$$

$$\begin{array}{r} 25 \\ 27 \\ \hline 52 \end{array}$$

Consumer's Equilibrium

Consumer's Equilibrium refers to that point where the total utility of the consumer is maximized given his budget constant.

Indifference Curve

An indifference curve of the consumer represents the different combinations of the commodities which will give the consumer the same level of satisfaction.

utility $\Rightarrow U = f(x, y)$

change: $\frac{\partial U}{\partial x}dx + \frac{\partial U}{\partial y}dy$

$\Rightarrow MU_x dx + MU_y dy = 0$

$-\frac{dy}{dx} = \frac{MU_x}{MU_y}$ = marginal rate of Substitution.

Marginal rate of Substitution:- MRS_{XY}

It refers to the rate at which the consumer is able to substitute one commodity with another without affecting his total utility level.

Table

Combination	Units of X	Units of Y	Utils	MRS
A	1	30	U_0	—
B	2	24	U_0	6:1
C	3	19	U_0	5:1
D	4	15	U_0	4:1

Budget Line →

- $M = P_x Q_x + P_y Q_y$ (say \$ 100)
- M = total budget (say \$ 100)

P_x = price per unit of commodity x (say ₹10)

P_y = " " " " y (say ₹50)

Q_x & Q_y Quantity of commodity X & Y.

2nd Class in Pdf.

3rd class in Pdf.

Diminishing marginal utility

Elasticity of Demand

Ed refers to the proportionate change in quantity demanded of a product due to a certain proportionate change in
(1) price (2) income (3) Price of related commodity

3 types of Ed :-

(1) Price elasticity of demand $= f(P_x, \bar{Y}, \bar{P_y})$ (e_p)

Income Ed shown as $e_i = f(y, \bar{P_x}, \bar{P_y})$

Cross Ed shown as $e_c \Rightarrow f(P_y, \bar{Y}, \bar{P_x})$

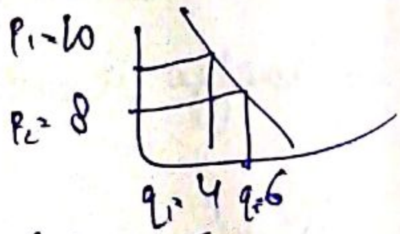
1. $e_p = \dfrac{\text{Proportionate change in quantity demanded}}{\text{Proportionate change in price}}$

$$= \frac{\Delta q / q}{\Delta p / p} = \frac{\Delta q}{\Delta p} \frac{p}{q}$$

$(p \ \& \ q) \rightarrow$ initial value

$\Delta q - q_1 - q_2$

$\Delta p - p_1 - p_2$



$\Delta p = 2$

$\Delta q = -2$

$$-1 \times \frac{\cancel{10}\,5}{\cancel{4}\,2} = \frac{-5}{2}$$

(inverse relation between price and demand)

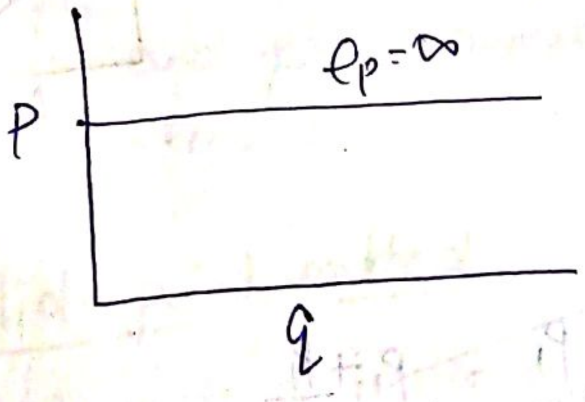
Price elasticity will always have a negative sign. because of the inverse relationship between quantity and price.

So for interpretation we take its absolute value.

for every 1% change in price, the quantity is responding by 2.5%.

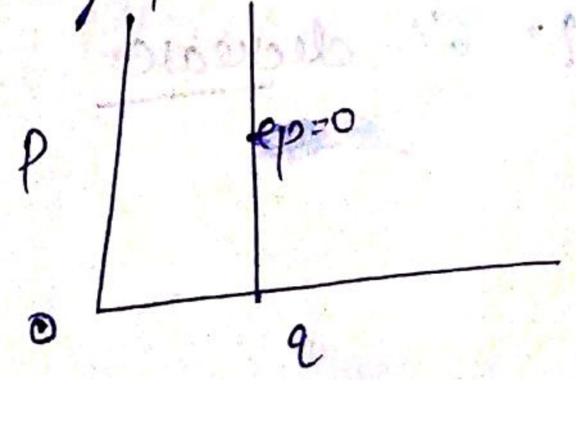
Degree of Price Ed :-

① Perfectly elastic demand :- In this case without any change in price the quantity demanded respons infinitely



② Perfectly inelastic demand :-

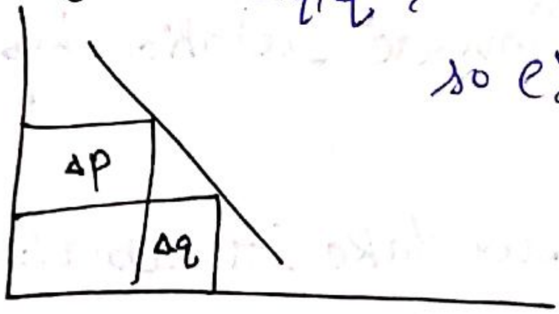
demand does not change in price, whatever the change in price.



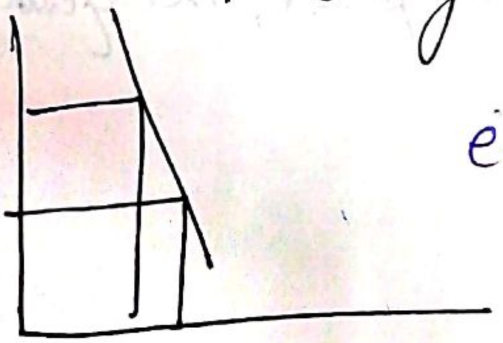
3. Relatively elastic demand

$\Delta q/q > \Delta p/p$

so $e > 1$

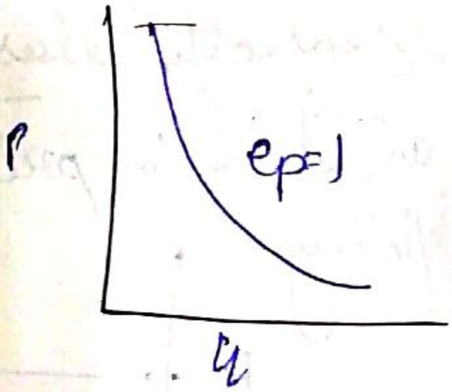


4. Relatively inelastic demand



$e < 1$

5 Unitary elastic demand.



Ques $e = 1.2$

$\cancel{P = P_1}$

$\cancel{P' = P_1 + \frac{5}{100}P_1 = P_1 + \frac{P_1}{20}}$

$$1.2 = \frac{\Delta q/q}{0.05}$$

$\Delta q/q = 6\%$ decrease

Methods of Measuring Price Ed:

(i) Point/percentage method
(ii) Mid-point method
(iii) Total revenue method
(iv) Graphical method.

(1) Percentage method

$$e_p = \frac{\Delta q}{\Delta p} \frac{p}{q}$$

Bcz getting diff value.

The limitation of this method is that it gives different values of price elasticity even for the same absolute change in quantity and price depending on the initial value taken.

(ii) Mid-point method

In this method, insted of taking the initial values we will take the average of the price and quantity variable.

$$(\Delta q / \Delta p) \times \frac{P_1 + P_2}{q_1 + q_2}$$

Ques $q_1 = 80$ $p_1 = 1$

$q_2 = 48$ $p_2 = 2$

80
48

32

$$E_d = \frac{-\cancel{32}}{1} \times \frac{3}{\cancel{64}_{2} \times 2} = \left|\frac{-3}{4}\right|$$

80
48

128

2

$= 0.75$

its < 1 , so relatively inelastic

(iii) Total revenue method.

e/p = TR = p × q

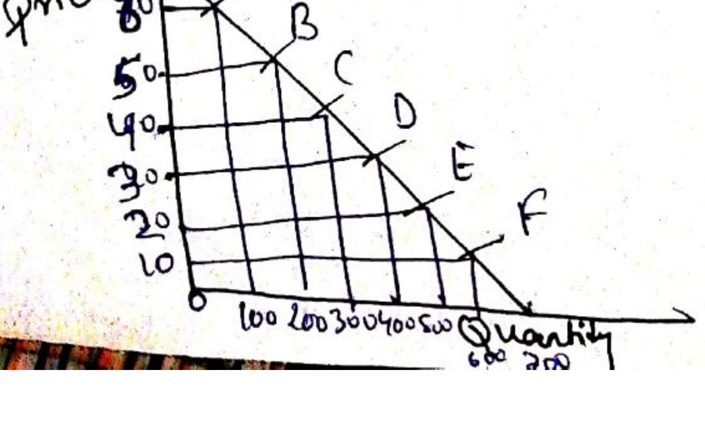
In this method we observe the total revenue of the producer before and after the price change to know about the elasticity of the product.

Reverse change of Q is less.

P↑ × QD↓ ⇒ TR↑
P↓ × QD↑ ⇒ TR↓ ⇒ inelastic.

P↑ × QD↓ = TR↓
P↓ × QD↑ TR↑ ⇒ elastic

Same - inelastic



Ques

(i)

The pric very and

Ques

for A, B

$$\frac{\Delta q}{\Delta p} \times \frac{P_{av}}{q_{av}}$$

$$= \frac{100}{-10} \times \frac{110}{300} = \frac{11}{3}$$

$= 3.66 > 1$

Relatively elastic

for C, D

$$\frac{100}{-10} \times \frac{90}{500} = 1$$

for E & F = 0.27

(ii) B & A

$50 \rightarrow 60$

$T_R = 50 \times 200$

$T_R = 6000$

Revenue is falling

elastic product.

The producer should not go for the price increase because the product is very elastic in this price range, means A→B and so the revenue is falling.

Scanned by CamScanner

Q-2 $P_1 = 150$

$P_2 = 142.5$

$q_1 = 2000$

$e_p = 0.7$

$TR_1 = 150 \times 2000$

$= 300000$

$0.7 = \frac{2000 - q_2}{150 - 142.5} \times \frac{150 + 142.5}{2000 + q_2}$

$0.7 = \frac{(2000 - q_2)(292.5)}{(7.5)(2000 + q_2)}$

$0.7 = \frac{\Delta q}{7.5} \times \frac{\cancel{150}^{3}}{\cancel{2000}_{40}}$

$0.7 = \frac{\Delta q \times \cancel{3}}{\cancel{300}_{100}}$

$70 = \Delta q$

$q_1 - q_2 = \Delta q$

$2000 - q_2 = 70$

$2000 + 70 = q_2$

$1930 = q_2$

$TR_2 = (1930)(142.5) = 275,025$

$\begin{array}{r} 150 \\ 142.5 \\ \hline 07.5 \end{array}$

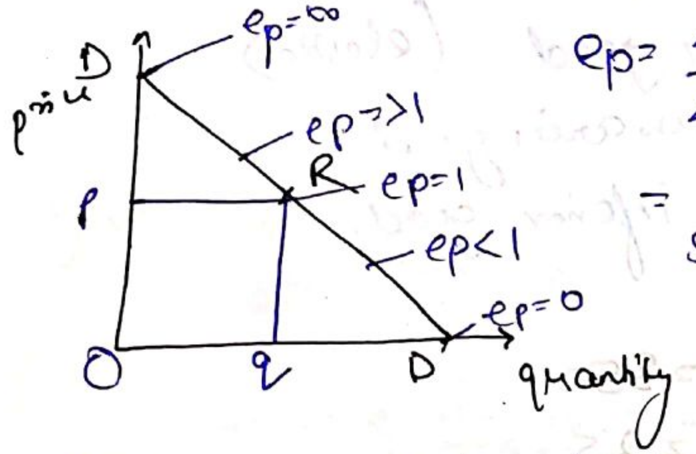
$\begin{array}{r} 150 \\ 142.5 \\ \hline 292.5 \end{array}$

$\begin{array}{r} 75 \\ 4 \\ \hline 300 \end{array}$

$\begin{array}{r} 2000 \\ 70 \\ \hline 1930 \end{array}$

Scanned by CamScanner

Graphical method



$$e_p = \frac{\Delta q}{\Delta p}\cdot\frac{P}{q} = \frac{1}{\Delta P/\Delta q}\cdot\frac{P}{q}$$

$$= \frac{1}{\text{Slope of } DD_1}\cdot\frac{OP}{Oq}$$

$$= \frac{1}{PD/PR}\cdot\frac{OP}{PR} = \frac{OP}{PD}$$

Triangle PDR is similar to ΔqRD_1 → so would have proportional sides.

$$e_p = \frac{OP}{PD} = \frac{qR}{PD} = \frac{RD'}{RD} = \frac{\text{lower segment of } DD_1}{\text{upper segment of } DD'}$$

Income Elasticity of Demand (e_i)

It will measure the proportionate change in quantity demanded of the product due to a ~~second~~ certain proportionate change in income of the consumer.

Percentage method ⇒ $e_i = \frac{\Delta q}{\Delta Y}\cdot\frac{Y}{q}$

ARC / Mid point ⇒ $e_i = \frac{\Delta q}{\Delta Y}\cdot\frac{Y_1+Y_2}{q_1+q_2}$

It will be +ve,

Values of e_i

If $e_i > 1 \Rightarrow$ luxury good (elastic)

$e_i < 1$ — necessaries good

$e_i < 0$, It is inferior good.

Ques $I_1 = 800 \quad I_2 = 850$

$q_1 = 25 \quad q_2 = 35$

$$e_i = \frac{+1\cancel{0}}{\cancel{5}\cancel{0}} \times \frac{\overset{13}{\cancel{650}}}{60} = \frac{13}{6}$$

25
35
60

Cross Elasticity of Demand

It will measure the proportionate change in quantity demanded of a product due to a certain proportionate change in the price of some other related commodities.

Percentage method -

$$e_c = \frac{\Delta q_x}{\Delta p_y} \cdot \frac{P_y}{q_x}$$

Mid point

$$e_c = \frac{\Delta q_x}{\Delta P_y} \frac{P_{y_1} + P_{y_2}}{q_{x_1} + q_{x_2}}$$

500
1100

Scanned by CamScanner

$e_c > 0 \Rightarrow$ Substitute
$e_c < 0 \Rightarrow$ complement
$e_c = 0 \Rightarrow$ unrelated

Ques

$\cancel{\frac{20}{50}} \cancel{\frac{8}{35}} = 2$

$\Delta q \Rightarrow \cancel{\frac{10}{1} \times \frac{3}{42} = \frac{4}{5}}$

Tea & coffee

$e_i \Rightarrow \frac{-10}{-1} \times \frac{4}{50} = \frac{4}{5}$ substitute

Bread & Butter

$e_i \Rightarrow \frac{-10}{1} \times \frac{7}{80} = -\frac{7}{8}$ complementary

Ques $P_1 = 100$ $P_2 = 110$
$I_1 = 100$ $I_2 = 105$

$p_i = -1.4$
$I_i = 2.2$

$Q_1 = 50000$
$P_1 = 10000$ $P_2 = 1000 \times \frac{10}{100} = 100$

$\left(-1.4 = \frac{\Delta q / q}{0.10}\right) + 2.2 = \frac{\Delta q / q}{0.05}$

Net effect →

$-14 + 11 = -3\%$

$TR = 5 \times 10^8 = 5$ crore
$TR_2 = (q - \Delta q)(p + \Delta p)$
$(48500)(11000) = ₹\ 53.35$ crore

$$\frac{MU_x \times P_x}{P_m} \quad M_u$$

$$TR = p \times q$$

$$\frac{dTR}{dq} = p + q\frac{dp}{dq}$$

$$= p\left[1 + \frac{q}{p}\frac{dp}{dq}\right]$$

$$MR = AR\left(1 - \frac{1}{e_p}\right) \quad \because AR = p$$

$$e_p = \frac{-dq}{dp}\cdot\frac{p}{q}$$

$$e_p = \frac{AR}{AR-MR}$$

Ques. 4 $\quad P = 50 - 3x$

$$3x = 45 \quad \cancel{3x = 45}$$

$$x = 15 \quad \cancel{x = 15}$$

$$P = 50 - 3x$$

$$\frac{dx}{dp}\cdot\frac{p}{x} = e_p$$

$$P = 50 - 3x$$

$$\frac{dp}{dx} = -3$$

$$\frac{1}{3} \times \frac{5}{15 \cdot 3} = \frac{1}{9}$$

$$MR = P = 5$$

$$MR = \frac{dTR}{dx} =$$

$$P = 50 - 3x$$

$$TR = 50x - 3x^2$$

$$\frac{dTR}{dx} = 50 - 6x$$

$$= 60 - 90$$

$$= \cancel{30} - 40$$

$$\frac{18}{98}$$

$$ep = \frac{5}{5-(-40)} = \frac{1}{9}$$

$$P = 400 - 2q - 3q^2$$

$$\frac{dP}{dq} = -2 - 6q \qquad P = 400 - 20 - 300$$

$$P = 80$$

$$\frac{dP}{dq} = -2 - 60$$

$$= -62$$

$$\% = \frac{1}{-\cancel{62}_{31}} \times \frac{\cancel{80}^{4}}{1\cancel{0}} = -\frac{4}{31}$$

$$MR = P = 80$$

$$TR = 400q - 2q^2 - 3q^3$$

$$\frac{dTR}{dx} = 400 - 4q - 9q^2$$

$$= 400 - 40 - 900$$

$$= -540$$

$$\begin{array}{r} 540 \\ 80 \\ \hline 620 \end{array}$$

$$\frac{80}{80 + 540} = \frac{8\cancel{0}}{62\cancel{0}} = \frac{4}{31}$$

Classin Pdf

5. Equal Payment Present worth factor

$$P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] = A(P/A, i, n)$$

$$P = \frac{A}{(1+i)} + \frac{A}{(1+i)^2} + \cdots \frac{A}{(1+i)^n}$$

Divide both sides with $(1+i)$

$$\frac{P}{(1+i)} = \frac{A}{(1+i)^2} + \frac{A}{(1+i)^3} + \cdots \frac{A}{(1+i)^{n+1}}$$

Subtract (II) from (I)

$$P - \frac{P}{(1+i)} = \frac{A}{(1+i)} - \frac{A}{(1+i)^{n+1}} \quad \text{— (III)}$$

$$P(1+i) - P = A\left[1 - \frac{1}{(1+i)^n}\right] \quad \text{— (II)}$$

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

The objective of this mode of investment is to find the present worth of a series of annuity investment made at the end of each interest period.

Scanned by CamScanner

6 Capital Recovery factor

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

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

The objective of this mode of investment is to find the ~~present~~ total ~~worth~~ ~~of a series~~ at the end of each interest period of annuity investment made, to recover the ~~capital~~ presently invested sum of the capital.

Interest Formula

(1) Single Payment Future Worth factor:

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

(2) Single Payment Discount Factor

$P = F\left(1/(1+i)^n\right)$

(3) Equal Payment Future Worth Factor

$F = A\{[((1+i)^n - 1)]/i\}$

(4) Equal Payment sinking fund factor. (convert to a)

$A = F\{i/[(1+i)^n - 1]\}$

(5) Equal Payment Present worth factor

$P = A\{[(1+i)^n - 1]/[i(1+i)^n]\}$

(6) Equal payment capital recovery factor.

$A = P[i(1+i)^n]\}/[((1+i)^n - 1)]$

(7) Uniform gradient series formula.

$A = A_1 + G\{[(1+i)^n - 1 - in]/[i(1+i)^n - i]\}$

$P \rightarrow 0^{th}$ –

$F = n^{th}$ – last

$A \Rightarrow$ Yearly

(1) $F = 10$ Lakh

$$P = F\left[\frac{1}{(1+i)^n}\right]$$

$$P = 1000000\left(\frac{1}{(1+0.15)^{10}}\right)$$

$$= 100000\left(\frac{1}{(1.15)^{10}}\right)$$

$$= 1000000\left(\frac{1}{4.04}\right)$$

$= 24752.4$

$= 2.47$ lakh

Ques

$\cancel{A = F \{ i / [1+i}$

$A = 10000$

$n = 25$

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

$$F = 10000\ \frac{[(1+0.2)^{25} - 1]}{0.2}$$

$$F = 10000\left[\frac{94.39}{0.2}\right]$$

$F = 4.769$

Ques. 3 F = ?

P = 50000

F = 50000 $(1+0.05)^{30}$

= 50000 (4.32)

= 5.03 lakh

Ques. 4

P = 20 lakh

A =

$$A = 2000000 \frac{[0.12(1.12)^{20}]}{[(1.12)^{20}-1]}$$

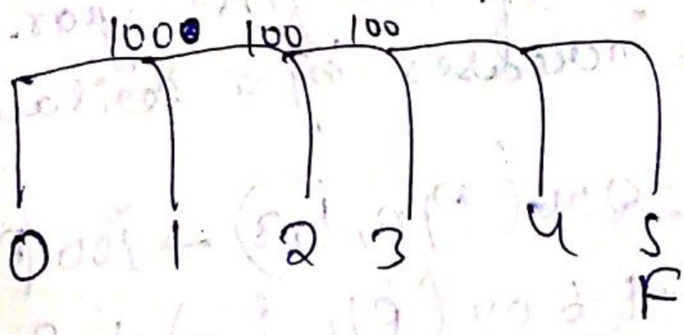
$$A = 2000000 \frac{(1.157)}{(8.646)}$$

A = 2000000

A = 2.67 lakh

Ques 1 n = 5

Cash flow diagram



(5)+(1) $P = A\{[(1+i)^n - 1] / [i(1+i)^n]\}$

$459

(6) P = 100{[

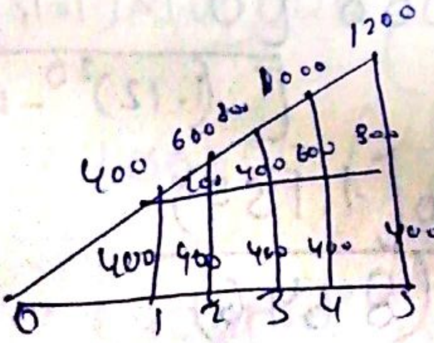
60
35
25

7 Uniform Gradient Series formula:

400 ⇒ Base annuity - A
200 → Gradient - G

n = 5 years

400, 400+200, 400+400, 400+600,
400 + 800
A, A + 1G, A + 2G, A + 3G, A + 4G - A



The objective of this mode of investment is to find the annuity amount equivalent to a given series of investment with a base year amount at the end of the first year. which thereafter increases by a certain gradient

$$F = 200(F/P, i, 3) + 400(F/P, i, 2) + 600(F/P, i, 1) + 800 \ldots$$

$$= 1G(1+i)^3 + 2G(1+i)^2 + 3G(1+i)$$

multp $(1+i)$ both sides.

$$F(1+i) = 1G(1+i)^4 + 2G(1+i)^3 + 3G(1+i)^2 + 4G(i+1) - (11)$$

Subtract (iii) from (v)

$$F - F(1+i) = -G(1+i)^4 - G(1+i)^3 - G(1+i)^2 - G(1+i) + 4G$$

$$F_i = G\left[(1+i)^4 + (1+i)^3 + (1+i)^2 + (1+i)^1 + 1\right] - nG$$

$$F_i = G(F/A, i, n)$$

To convert into annuity
mult $(A/F, i, n)$

$$A^* i = G\left[1 - \frac{ni}{(1+i)^n - 1}\right]$$

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

$$A = A_1 + A^*$$

Ques 4 $A_1 = 400$, $G = 200$, $n = 5y$, $i = 10\%$

$$A = 200\left[\frac{(1.1)^5 - 1 - (0.1)(5)}{(0.1)(1.1)^5 - 0.1}\right]$$

$$A^* = 200\left(\frac{(1.61) - 1 - 0.5}{(0.1)(1.61) - 0.1}\right)$$

$$A^* = 200\left(\frac{0.11051}{0.061}\right) = 362.32$$

$$A = 400 + 362.32$$

Ques $i = 15\%$

$A_1 = 4000$

$$A = 500\left[\frac{(1+0.15)^{10} - 1 - 0.15}{(0.15)(1.15)^{10} - 0.15}\right]$$

$$A = 500\left[\frac{4.04 - 1 - 0.15}{(0.15)(4.04) - 0.15}\right]$$

$$A' = 500\left[\frac{2.89}{0.456}\right] = 3168.85$$

$=$

$$A = A_1 + A' = 5691$$

$$F = 5691\left\{\frac{(1.15)^{10} - 1}{0.15}\right\}$$

$$= 5691\left\{\frac{3.045}{0.15}\right\}$$

$$= 115548$$

Ques $G = 500,\ A_1 = 8500$

$i = 15\%,\ n = 10$

~~A = 8500~~ $A = 8500 - 1691.11$

$A =$ ~~10191.1~~ 6808.9

~~F = 10191.1~~

$F =$ ~~2068879.8~~ 1.38 Lakh

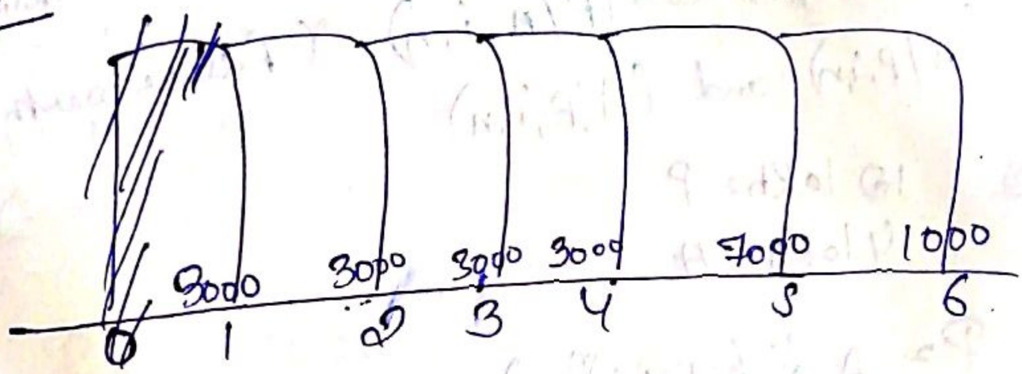
Ques $G = 30$, $A = 120$, $i = 5\%$ 1.05

$$A = \left[120 + 30\left(\frac{(1+i)^n - 1 - in}{i(1+i)^n - i}\right)\right]$$

$$A = \left[120 + 30\left((1.05)^{10}\right.\right.$$

$F = 762.-$

Q-3



$P = ?$

$$P = \left[3000\left\{\frac{[1+0.14]^4}{(0.14)(1.14)^4}\right\}\left(\frac{7000}{(1.14)^5}\right)\right.$$

$$\left. + \frac{1000}{(1.14)^6}\right]$$

Bases of Comparisons of alternatives

Time bases for comparison.

(1) Present worth criteria

In this method of comparison, we convert all the cash flow details to the 0th year for evaluation.

(1) ~~Pre~~ $(P/F, i, n)$ and $(P/A, i, n)$ (Present worth criteria)

(2) $(F/P, i, n)$ and $(F/A, i, n)$ - (Future worth cri...

(3) $(A/P, i, n)$ and $(A/F, i, n)$

Ques 12 lakh = P
4 lakh = A

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

$$P = 4 \left\{ \frac{(1.20)^{10} - 1}{(0.20)(1.20)^{10}} \right\}$$

$$P = 4 \left(\frac{5.19}{1.238} \right)$$

$$P = 16.76$$

Profit = 16.76 - 12 lakh
= 4.76

Scanned by CamScanner

$PW_2 =$

~~P = 6~~

(2) Profit = 5.15 L

(3) Profit = 2.96 L

Future worth

$$FW_1 = -12L(F/P, i, 10) + 4L(F/A, i, 10)$$

A will be return

Ques

$P = 4,50000$

$n = 15$

$C = 30000$

(5) $$PW_1 = 30000 \left\{ \frac{(1.15)^{15} - 1}{(0.15)(1.15)^{15}} \right\}$$

$$P_2 \ 30000 \left\{ \frac{7.13}{(1.22)} \right\}$$

$P_2 \ 175327.86$

Cost

$P_2 = 6.25$ Lakh $= PW_1$

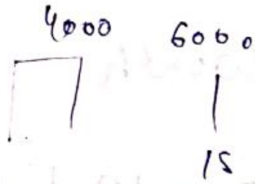
$PW_2 = 6.56 =$ Cost

The first project is selected because its cost is less.

Scanned by CamScanner

Q3 $P = 1000$
$n = 15$
$F = 12000$ } Scheme I

$P = 1000$
$F = 4000$
$n = 10$



$$P = 12000\left\{\frac{1}{(1+0.12)^{15}}\right\}$$

Project 2.19 L

$PW_1 = -1000 + 2.19$
$= 1.19$

$PW_{II} =$ ~~817.84~~

$$PW_2 = -1000 + \left[\frac{4000}{(1.12)^{10}} + \frac{6000}{(1.12)^{15}}\right]$$
$= 1386$

Ques 4

$$P = -10000 + \left[\frac{3000}{1.18} + \frac{3000}{(1.18)^2} + \frac{7000}{(1.18)^3} + \frac{6000}{(1.18)^4}\right]$$

$P = -10000 + 2542.3 + 905.6$
$4260.4 + 3094.7$
$PW_1 = 803.03$

Nominal and effective rate of intrest

In case of nominal rate, the compounding is done once in a year. In case of effective rate. The compounding is done more than once in a year.

$$r = \left(1+\frac{i}{m}\right)^m - 1$$

m = the number of compounding done per year.

$$r = \left(1+\frac{i}{m}\right)^m - 1$$

$$F = P\left(1+\frac{i}{m}\right)^{m \times n}$$

Ques

$$r = \left(1+\frac{0.13}{2}\right)^2 - 1$$

$$r = \left(1 + \quad\right)^2$$

$$r = 0.034$$

$$r = \left(1+\frac{0.13}{4}\right)^4 - 1 = 13.64$$

$$r = \left(1+\frac{0.13}{12}\right)^{12} - 1$$

$$r = \left(1+\frac{0.13}{52}\right)^{52} - 1$$

$1\frac{1}{2}$ $\frac{3}{2}\%$

~~$i = 1.5\%$~~

~~$i = \left(1 + \frac{i}{m}\right)^m - 1$~~

~~$i = \left(1 + 0.015\right.$~~

$i = \frac{3}{2} \times 4^2 = 6\%$ ← nominal rate

$r = \left(1 + \frac{0.06}{4}\right)^4 - 1$

$r = 6.19$ (Effective rate)

Que

$i = 15\%$

$m = 4$

$n = 3$

$F = 1000\left(1 + \frac{0.15}{4}\right)^{12}$

$= 1000(1.555$

Q-3

P → 8m

F → n^m

A - repeating every year

each year = A

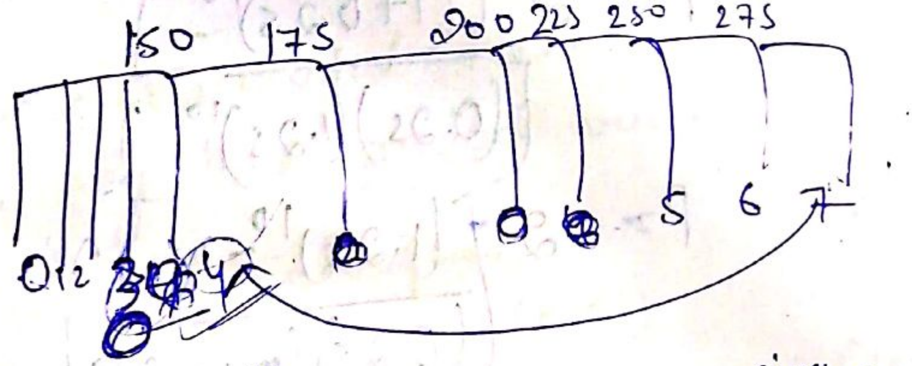
$P = \left[8000\left(\frac{(1.14)^4 - 1}{(0.14)(1.14)^4}\right)\right.$

$$P = 3000\left(\frac{0.688}{0.236}\right)$$

$$= 87457.62$$

P_2

Ques



P — 0^{th} year $G \xrightarrow{\text{gives}} A$

$P = ?$

7 A $A = 150$

5 P $G = 25$

2 $P = [150 + 25 ($

(5) $P = 16$ lakhs 18%

$i = 25\%$

$A = 2$ lac

$n = 10$ yr

$$P = 2\left[\frac{(1+0.25)^{10}-1}{(0.25)(1.25)^{10}}\right]$$

$$P = 2\left[\frac{(1.25)^{10}-1}{(0.25)(1.25)^{10}}\right]$$

$$= 2\frac{(8.31)}{(2.32)}$$

$= 7.16 + 4L$

$= 12.98$

$= \cancel{C28L}$

Scheme I - 16

Scheme II - 12.98 ✓

Capital Budgeting Techniques OR Investment Criteria

They refer to the different criterias based on which we either accept or reject a given investment proposal

(1) Non - discounted techniques:-
The pay-back period criteria.

(2) Disounted Techniques
(i) Net present value (NPV)
(ii) Internal rate of return criteria (IRR) and
(iii) Benefits - cost ratio criteria.

Pay back period criteria
It refers to the minimum no of years within which the initial cost of investment is recovered

I. Pay back in case of annuity returns.

$$P_B = \frac{\text{Initial cost}}{\text{annuity returns}}$$

$C_0 = 1$ Lakh

$A = 12,500$

$P_B = 8$ lakhs

II P_B in case of non-uniform return.

$C_0 = 20,000$

Yr	Return	P_B
1	8000	1
2	7000	1
3	4000	1
4	2000	$\frac{1000}{2000} \times 12 = 6$ months
5	2000	
6	4000	

3y 6 months.

Though the method is simple and cost effective but the limitations are

1. It gives no time preferance.
2. It ignores the returns after the pay back period.

Q-1 Project 1 – 3y 4 month

2 – 2y 10 month.

$\frac{1000}{3600} \times \cancel{174}$

$\frac{23996}{231064} \times \frac{6}{12}$

Net present value criteria - P

Return - cost

In this method we discount the returns from the project over the years and compare it with its initial cost for evaluation.

$$NPV = \left[\frac{R_1}{(1+i)} + \frac{R_2}{(1+i)^2} + \cdots \frac{R_t}{(1+i)^t}\right] - \left[C_0 - \frac{SV}{(1+i)^n}\right]$$

$$= \sum_{t=1}^{n} \frac{R_t}{(1+i)^t} - \left[C_0 - \frac{SV}{(1+i)^n}\right]$$

$F = SV$ - Resell value

R_t = Return value

C_0 = Initial cost

SV = Salvage value

i = opportunity cost of investment

Decision Rule

If $NPV > 0 \rightarrow$ accept

If $NPV < 0 \rightarrow$ reject

If $NPV = 0 \rightarrow$ state of indifference.

Scanned by CamScanner

* Salvage value refers to the scrap or end value of an asset when it is disposed off at the end of its productive lifetime.

i = market prevailing intrest

(1) $n = 10$

$P = 40000 = C_0$

$SV = 10000$

$i = 10\%$.

$$NPV = \left[\frac{7000}{(1.1)} + \frac{9800}{(1.1)^2} + \frac{10800}{(1.1)^3} + \frac{11100}{(1.1)^4} + \frac{9400}{(1.1)^5} + \frac{7600}{(1.1)^6} + \frac{5700}{(1.1)^7} + \frac{4000}{(1.1)^8} + \frac{2000}{(1.1)^9} + \frac{2000}{(1.1)^{10}}\right) - \left[40000 - \frac{1000}{(1.1)}\right.$$

$$NPV = 6363.63 + 8099.17 + 8114.19 + 7581.44 + 5836.66 + 4290 + 2925. + 1866.02 + 848.19 + 771.08 - [36144.56)$$

$$= 10550.82$$

Internal Rate of Return

$$\sum_{t=1}^{n} \frac{R_t}{(1+r)^t} = \left[C_0 - \frac{SV}{(1+i)^n} \right]$$

$r \uparrow$ profitable

IRR refers to that rate of discount which will make the present value of the returns equal to the initial cost of investment. Thus it is the rate of discount which will make the NPV of the project 0.

Decision rule

If $r > i$ = accept
$r < i$ = reject
$r = i$ = state of indifference.

IRR in case of annuity returns:

$$P = 1 \left[\frac{(1+0.15)^{10} - 1}{(0.15)(1.15)^{10}} \right]$$

$$P = 1 \left[\frac{3.04}{0.606} \right] = 7.600$$

Steps

① Calculate the p ratio = $\frac{\text{Initial cost}}{\text{Annuity returns}}$ eg 2.22

② find the range of IRR

③ The exact IRR = r = $\cancel{r_u}$

$$= r_n - \frac{P - P_L}{P_n - P_L}(r_n - r_L)$$

r_n and r_L are the upper value of rates in range.

P_n and P_L are p-ratios of r_n and r_L.

P = computed P-ratio.

Ques 1 (i) p ratio = $\frac{\cancel{60000}^{10}}{\cancel{18000}_{3}} = 3.33$

(ii) Range

r_L	r_U
25%	30%
3.859	3.268
P_L	P_U

(iii) $r = 0.03\ \cancel{0.028} - \left(\frac{3.33 - 3.859}{3.859 - 3.268}\right)(-0.05)$

~~r = 0.28 +~~

$r = 0.255$ or 25.53

(11) $P = 5.86$

r_L 16 to 17 r_u

6.097 5.766

P_L P_u

$$r = 0.17 - \left(\frac{5.86 - 6.097}{5.76 - 6.097}\right)\left(+0.01\right)$$

$$r = 0.17 - \left(\frac{5.86 - 6.097}{5.76 - 6.097}\right)(0.01)$$

$$= 0.17 + \left(\frac{0.237}{0.337}\right)(0.01)$$

$=$

most profitable (decreasing order)

// If opportunity cost is given select in order greater than r.

In case of non uniform returns, the IRR is calculated by the trial and error method which utilizes the concept that, it is the rate of discount which makes the NPV = 0.

Steps

(1) Take any arbitary rate of discount and find the NPV of the project

If NPV +ve $r \uparrow$

-ve $r \downarrow$

If you get a +ve NPV increase the rate of discount and vice versa.
A negative and positive NPV gives us range of IRR

(ii) Within the range

$$IRR = r_L + \frac{d_L}{d_u}(r_u - r_L)$$

$d_L = NPV \text{ at } r_L - NPV \text{ required}$ =0

$d_u = NPV \text{ at } r_u - NPV \text{ at } r_u$

Ques $i = 20\%$

$$NPV = \cancel{\frac{16000}{0.2}} \left(\frac{8000}{(1.2)^1} + \frac{7000}{(1.2)^2} + \frac{6000}{(1.2)^3} \right) - [16000]$$

NPV = 40000 + 175000 + 7500

? − 1000

$i = 16\%$

NPV = −57

$i = 15\%$

NPV = ~~62566858~~ +194

$r_L \quad r_u$

$15 \quad -16$

$194 \quad -57$

$d_L \quad d_u$

$$r = 15 + \frac{194}{194-(-57)}(16-15)$$

$= \cancel{15 + 3.4033} = 1$

$$= 15 + \frac{194}{194+57}$$

$$= 15 + \frac{194}{251} = 15.77$$

~~Ques~~ $r = 15\%$

$$NPV = 30000\left(\frac{(1.15)^5 - 1}{(1.15)^5(0.15)}\right)$$

$$= 30000\,\frac{(1.01)}{(0.301)}$$

$= \cancel{99.86} \quad 100764.11$

$\quad -100000$

$= 764.11$

~~$r = 9\%$~~

~~$$NPV = 30000\left(\frac{(1.09)^5 - 1}{(0.09)(1.09)^5}\right)$$~~

30000

$r = 19\%$

$$NPV = 30000\left(\frac{(1.19)^5 - 1}{(1.19)^5(0.19)}\right)$$

$$30000 \; \frac{(1.38)}{(0.453)}$$

$$15 - 19$$

$$764.11 - \quad -8609.27$$

$$IRR = 15 + \frac{764.11}{(764.11 + 8609.27)}(0.04)$$

$$= 15 + \left(\frac{764.11}{9373.38}\right)(4)$$

$$= 15.32$$

$$PB = \frac{100000}{30000} = 3.33$$

(3) $C_0 = 1075$ $i = 15\%$

$$P = F\left[\frac{1}{(i+1)^n}\right]$$

$$NPV = \frac{150}{(1.15)^1} + \frac{300}{(1.15)^2} + \frac{450}{(1+1.5)^3} + \frac{600}{(1.+0.15)^4}$$

$$+ \frac{750}{(1.15)^5} - (1075)$$

$NPV = 130.43 + 226.84 + 295.88 + 343.05$

$+ 372.88$

$NPV = 1369.08 - 1075$

$NPV = 94.08$

$i = 16\%$

$NPV = 129.31 + 222.94 + 288.29$

$+ \cancel{320.17}\ 331.37 + 3575.07$

Benefit - cost ratio criteria

In case of public alternatives like the provision of Health and educational facilities, infrastructure facilities etc. the concerned authority evaluates

$\frac{B}{C}$ ratio of the project which if at least ≥ 1 is accept otherwise rejected

Ques $C_0 = 40$ lakh $= P$ F

$n = 15$

$A = 1,50000$

$Fuel_1 = 6$ lakh

$Fuel_2 = 50,000$

$i = 12\%$

$$A = \cancel{150000}\ 600000 + 50000\left[\frac{(1.12)^{15} - 1 - (0.12)(15)}{(0.12)(1.12)^{15} - (0.12)}\right]$$

$$A = 600000 + 50000\left[\frac{4.47 - 1.8}{0.53}\right]$$

$$A = 851886.79$$

$$~~A = 4000000\left(\frac{(1.12)^{15}0.12}{(1.12)^{15}-1}\right)~~$$

$$~~A = 4000000\left(\frac{0.65}{4.47}\right)~~$$

$$F = 851886.79\ \frac{(1+0.12)^{15}-1}{(0.12)}$$

$$F = 3175\ 8096.45$$

$$F = 4000000(1.12)^{15}$$

$$C \rightarrow F = 21894263.04$$

$$\frac{B}{C} = \underline{1.15}$$

$$~~A = 2\ 5816055.481~~$$

Ques $P = 15\ 0000000$

A should be deducted from cost

$A = 20+25+35+10$

$A = 90$ lakh $= B$

$P =$ ~~1000 lakh~~ 1400 lakh

C $A = 1500\left(\frac{(0.09)(1.09)^{50}}{(1.09)^{50}-1}\right)$

$= 1500\left(\frac{6.89}{73.35}\right) = 102636.80$

Project A

$\frac{B}{C} = 1.23$

Project B –

$A = 25 + 35 + 45 + 20$

$A = 125$ lakh

$$A = 2500 \frac{(1.12)^{50}(0.12)}{(1.12)^{50} - 1}$$

$$A = 2500 \frac{34.68}{288.002}$$

$A = 301.03 = 0.415$

(ii)

(iii)

Depreciation of an accet

Depreciation of an accet refers to the loss in productivity over its lifetime which is interpreted in 3 sence.

(1) Physical depreciation "which refers to the actual decline in productivity of an accet measured in terms of goods and services produced.

~~Cloted~~

(ii). Economic depreciation
It refers to the loss in value due to factors other than physical depreciation like the obsolescence of technology, change in choice of consumer etc.

(iii) According Depreciation.
It refers to the total loss in productivity of the asset both due to physical as well as economic depreciation.

---

pdf

Production Analysis

Consumption – Destruction of utility.

production – Creation " "

The concept of production not only refers to the physical transformation of input into output but also includes their storage, transport, exchange and distribution till they reach the final consumer.

Ques Production is defined as the creation of utility.

Concepts of Production

① Production Function

- Short run Production
- Long " "

The production f^n is defined as the technical relationship between the output and the different inputs of production.

$Q = f$ [Land (N), Labour (L), capital (K), organisation (O), raw material(r)]

① Short run production f^n:-

If the producer is able to vary the output only by changing the variable factors of production while he is constraints by certain fixed factors, the production f^n is said to be in the short run which is observed by the law of variable proportion.

② Long run production function:-

When the producer has no constraints of any fixed factor then the production process is said to have entered the long run which is observed under the law of return to scale.

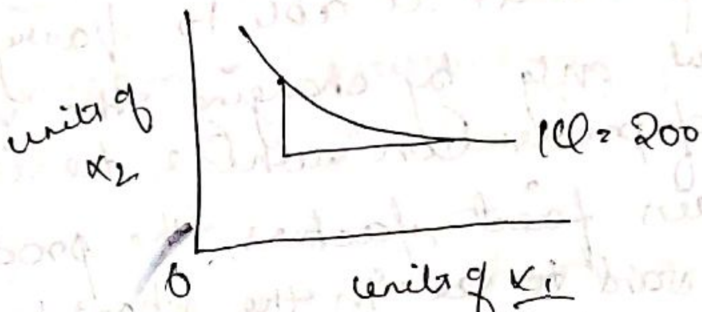
The producer's equilibrium :- (PEC)

A producer is in equilibrium at the point where he maximises the production f^n given the cost constraints or minimises the cost, given the output constraints.

$$P.F = q_0 = F(x, x_2)$$

Scanned by CamScanner

Isoquant Curve



Isoquants

Production Schedule:

Combination	x_1	x_2	Q const	$MRTS_{x_1 x_2}$
A	1	15	200	—
B	2	11	200	4:1
C	3	8	200	3:1
D	4	6	200	2:1
E	5	5	200	1:1

An isoquant curve of the producer represents the different combination of the inputs which will give the producer the same level of output.

$$dq_0 = \frac{dq_0}{dx_1} dx_1 + \frac{dq_0}{dx_2} dx_2$$

$$= f_1 dx_1 + f_2 dx_2 = 0$$

$$-\frac{dx_2}{dx_1} = \frac{f_1}{f_2} = \frac{dq_0/dx_1}{dq_0/dx_2}$$

$= \dfrac{\text{marginal production of } x_1}{\text{marg. production of } x_2}$ = Marg. rate of Technical substitution

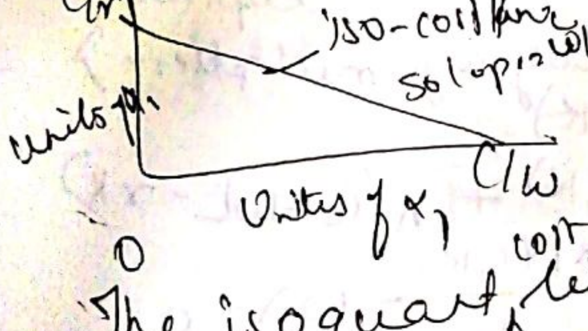
$$MRTS_{x_1x_2} = \frac{-dx_2}{dx_1} = \text{slope of isoquant}$$

$$= \frac{MP_{x_1}}{MP_{x_2}}$$

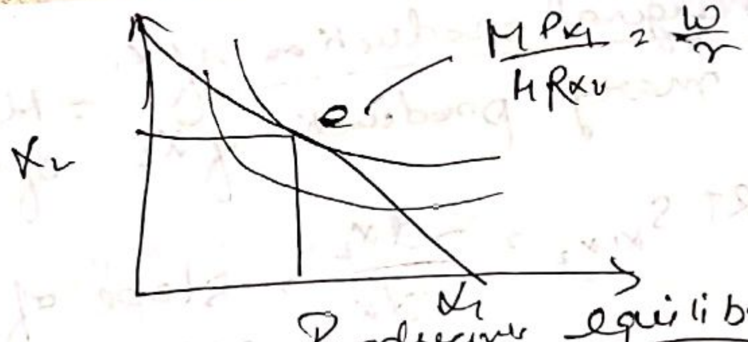
The $MRTS_{x_1x_2}$ refers to the rate at which the producer will be able to substitute one input with another without affecting the total output.
It is -ve impying that lessar and lessar quantity of 1 input can be given up to substitute some other factor under the technical assumption that no particular input can be a perfect substitute of some other vactor though the producer can only varry their combination.

Iso cost Line => $C = wx_1 + rx_2$

C = total cost of production
w = cost of input x_1
r = " " " of input x_2



The isoquant cost line of production express the different combinations which the producer can afford with his total cost of production.



Producer's equilibrium

The producer will be in equilibrium at the point where the isocost line is tangent to the highest attainable isoquant curve ~~highest attainable~~ which satisfies the following condition.

$$\frac{MP_{x_1}}{MP_{x_2}} = \frac{w}{r}$$

Derivation of public equilibrium condition (1)

Maximise $Q = F(L,K)$ subject to $(= wL + rK)$

L = Labour units

k = capital "

w = price per unit labour

r = price per unit of capital.

Lagrange multiplier = λ

$\cancel{Z = F(L,K)}$

$$Z = F(L,K) + \lambda(C_0 - wL - rK)$$

$$\frac{dZ}{dL} = 0 \Rightarrow \frac{\partial F(L,K)}{\partial L} - w\lambda = 0$$

$$\Rightarrow MP_L - w\lambda = 0 \quad (2)$$

Scanned by CamScanner

$$\frac{dz}{\partial K} = 0 \Rightarrow \frac{df(L,K)}{\partial K} - r\lambda = 0$$

$$\Rightarrow MP_K - r\lambda = 0 \quad (ii)$$

$$\frac{dz}{\partial \lambda} = 0 \Rightarrow C_0 - wL - rK = 0 \quad (iii)$$

$$MP_K - r\lambda = MP_L - w\lambda$$

$$\cancel{M(P_K - P_L) = \lambda(r - w)}$$

$$\cancel{\lambda = \frac{M(P_K - P_L)}{r - w}}$$

$$\frac{MP_L}{MP_K} = \frac{w}{r}$$

Write minimization condition.
minimize the cost constraints

1) Minimize $C = wL + rK$ Sub to $Q_0 = f(L,K)$

$$Z = wL + rK + \lambda(Q_0 - F(L,K))$$

$$\frac{dz}{\partial L} \Rightarrow 0 \Rightarrow w - \frac{\partial f(L,K)}{\partial L} = w - \lambda MP_L = 0 \quad (1)$$

$$\frac{dz}{dK} = 0$$

$$r - \lambda MP_K = 0 \quad (2)$$

$$\frac{dz}{d\lambda} = Q_0 - F(L,K) = 0$$

$$\frac{MP_L}{MP_K} = \frac{w}{r}$$

Q-1 $Q = \sqrt{LK}$ $K = 4$

$C = 80$

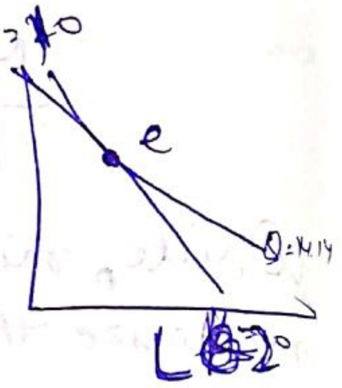
$Z = \sqrt{LK} + \lambda(80 - 2L - 4K)$

$\frac{dz}{dL} = \frac{1}{2}\frac{\sqrt{K}}{\sqrt{L}}$ - (i)

$\frac{dz}{dK} = 0$ - (ii)

$\frac{dz}{d\lambda} = 0 \Rightarrow 80 - 2L - 4K = 0$ - (iii)

$L = 2K$



$80 - 2(2K) - 4K = 0$

$K = 10$

$L = 20$

$Q = 20^{\frac{1}{2}} 10^{\frac{1}{2}}$

$= 14.14$

$\frac{MP_L}{MP_K} = \frac{\partial\varphi/\partial L}{\partial\varphi/\partial K} = \frac{w}{r}$

$Q = \sqrt{LK}$

$\frac{dq}{dL} = \frac{1}{2}\frac{K}{\sqrt{L}} - 2\lambda = 0$

$\frac{dQ}{dK} = \frac{1}{2}L^{1/2}K^{3/2}$

$\frac{MP_L}{MP_K} = \frac{w}{r} = \frac{1}{2}$

$\boxed{L = 2K}$

$x^{\frac{1}{2}}$

$80 - 2L - 4K = 0$

$80 - 2(2K) - 4K = 0$

$80 - 8K = 0$

$80 = 8K$

$\frac{80}{8} = K \quad K = 10$

$\boxed{K = 8}$

$\boxed{L = 10} \quad \boxed{L = 20}$

Ans 2

$\cancel{Q = 100}$

$PF = Q = 100L^{0.5}K^{0.5}$

$W = 30, \quad r = 40$

$C = 1200 \qquad K = \frac{3}{4}L$

$\frac{MP_L}{MP_K} = \frac{1}{2}L^{-3/2}\sqrt{K} \quad \frac{1}{2}K^{-3/2}\sqrt{L}$

$30L + 40K = 1200$

$L = 20$

$K = 15$

$Q = 1732.$

Ans 4

$PF = Q = 100K^{0.5}L^{0.5}$

$W = 50, \quad r = 40$

$100K^{0.5}L^{0.5} = 1118$

$50L + 40K = C$

$Z = 50L + 40K + \lambda(1118 - 100K^{0.5}L^{0.5})$

$4K = 5L$

$\boxed{L = \frac{4}{5}K}$

$\frac{dZ}{dL}$

Scanned by CamScanner

$100 K^{0.5} L^{0.5} = 1118$

$L \cong 10$

$K = 12.50$

$C = 1000$

(LAWS OF VARIABLE PROPORTION)

The short run production f^n. Observes the productivity changes in the short run when the producer has some constraints of the fixed factors.

Do sgurted employment — seurals

abt 100 gro (G)W

$\frac{V}{F} = \frac{100L}{100 \text{ acre}}$ 1 $\frac{200}{100}$

The law of variable proportion is the industrial propal of the concept known as distinguished employment observed in the short run

, there is a ~~[illegible]~~ fo

beyond the range of production, of the ~~[illegible]~~ starts declining.

Productivity Concepts

- Total product (TP_L) = Q
- It will refers to the total output produced with different combination of the fixed and the variable factors
- Average product (AP_L) $= \frac{TP}{\text{no. of variables unit}} = \frac{Q}{L}$

  It refers to the output per unit of the variable factors
- Marginal product (MP_L)

  Which refers to the change in total product due to a marginal change in the no. of variable units.

$$= \frac{\text{change in total product}}{\text{change}}$$

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

Assumptions of law variable proport

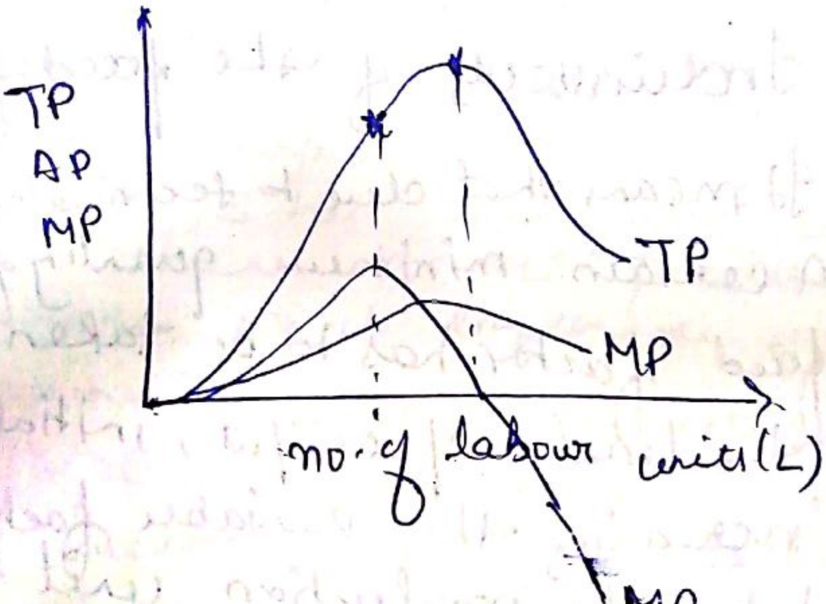
1. Constant state of technology
2. Short run phenomena
3. Possibility of variation in the proportion

Scanned by CamScanner

of the fixed and the variable factor.

Productivity Schedule.

Q	L	TP_L	AP_L	MP_L
10	0	-	-	-
10	1	5	5	5
10	2	15	7.5	10
10	3	35	11.67	20
10	4	45	11.25	10
10	5	50		5
10	6	50	1000	0
10	7	45	8.33 6.50	5



① Stage of Increasing region
From 0 level unit to where the AP_L is max.
② Stage of decreasing returns.
③ ① In This stage the total product initially increases at an increasing rate and Beyond a range of production starts the increasing at the diminishing rate, Input is the

short run production f^n when the total product takes a turn [illegible] is known as the point of inflection which represents the maximization of the marginal product of that i/p / o/p contribution.

This stage ends where the avg product is maximum., when it also coincides with the marginal product of the variable factor.

(i) Indivisibility of the fixed factor.

It means that due to technical requirement a certain minimum quantity of the fixed factor has to be taken whatever the level of output, initially increasing the variable factors takes the production unit towards its optimum combination with the variable factors, their by increasing the efficiency of both the factors.

(ii) Division of labour or Specialisation

With increasing variable factors the production process have specialization of the production process. This refers to sub dividing the task and assigning to each group a particular task. Doing the same work rapidly. Doing the same work repeatedly, increases their efficiency and also needs to less wastage of resources.

Stage of Decreasing returns.

1. ~~Scarcity of the fixed factors.~~

In this stage the total product continues to increase at an decreasing rate. In this stage both the avg product and the marginal product are declined but are still +ve. This stage ends where the ~~total~~ product is maximum, which employs the the marginal product of the variable factor will be zero. to the production process.

(2) Factors are imperfect substitutes of each other.

(3) With each increase in variable factors every additional unit will have lesser and lesser of the fixed factor to work with, thereby decreasing the efficiency of both the factors.

Factors are in
If some other factors could have replaced ~~also~~ the scares factors and optimum and ~~positions~~
could be maint.

but as the factors are employed such of each as — — —. ~~affected~~
decreasing product is ab to.

State of Negative Returns-

In this state the total products

Starts reducing which means the

Marginal productivity.

were -ve to TR (;Z;

This stage occurs when the

Variables factors are highered

much beyond the optimum capacity

of the fixed ~~ca~~

size that their over ~~...~~

utilisation leads to their frequent breakdown affecting the productivity of the overall production.

V : P

Rational producer will always operate in the second stage of production where every additional variable unit is still adding to the total output ~~[illegible]~~ ra q-pt

The producer will stop hiring any more ~~[illegible]~~ after stage 2 where the marginal product becomes 0.

pdy

Causes of Increasing returns to scale 31

The IRS occurs due to certain advantages of a large scale production units (LSU) which are known as "Economies of scale divided into

(i) Internal & (2) External economies. 4

Internal economies of scale

(1) Technical economies

a) with increased productivity of a large scale unit, the large per unit cost gets highly reduced

$$AC = \frac{TC}{Q} \text{ (total cost)}$$

(b) Their is better linking and coordination among the different sectors of a large scale unit.

(2) Managerical economies

A large scale unit can afford to higher the services of experts to manage and coordinate its diff sector.

3 Labour economies

a) With increasing variable factors, their occurs specialization in the production process, which increases their efficiency and also lits to less wastage of resources.

4 Marketting economies

A large scale unit have better marketing facilities like storage, transport advertisement, finance etc for wider publicity of its products.

5 Financial economies

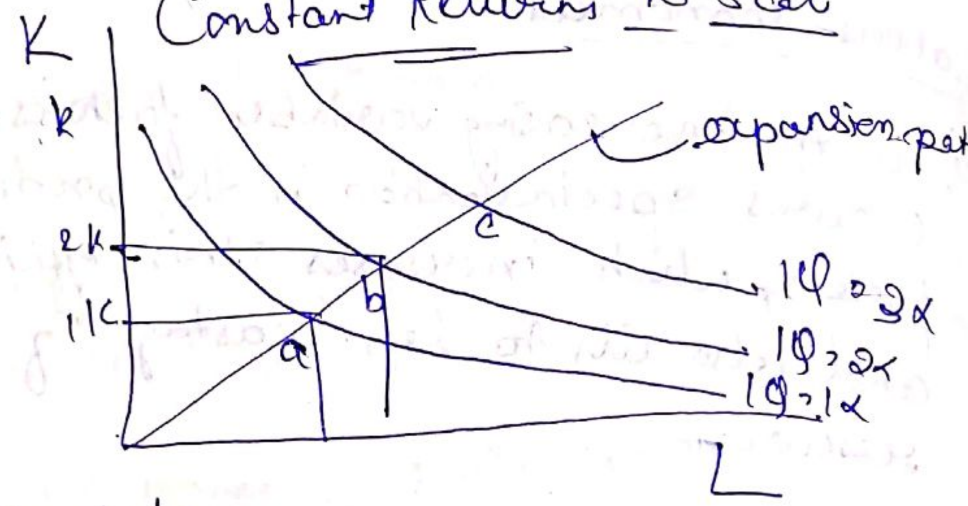
A large scale unit can raise huge capital from the market because of the superior goodwill its enjoys.

External economies

Some external advantages of a large scale units are :-

Better transport and communication, wider publicity of its products, better insurance coverage, advanced labour training centres etc.

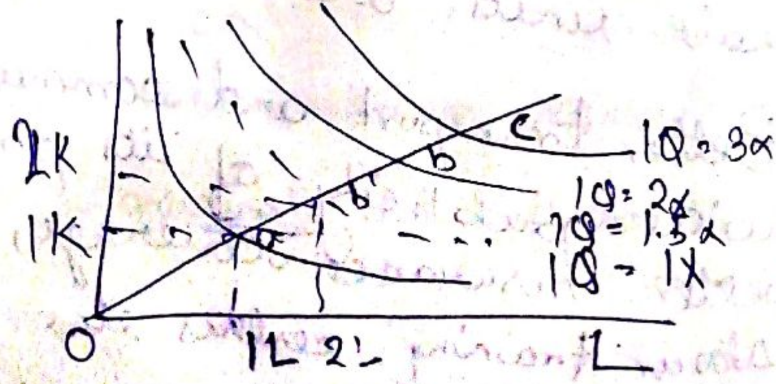
Constant Returns to Scal



aa = ab = bc

In this stage, the proportionat change in output is same as proportional change in input, which is implied by the equal distance between the successive isoquants. This phase ocurs where a firm has expanded beyond a certain optimum such that the economies of scale experienced by it in the initial phase gradually gets exhausted giving way to the diseconomies of large-scale production units.

Decreasing returns to scal



Oa < ab < bc

In this stage the proportionate change in output is less than the proportionate change given to all inputs which is implied by the increasing distance between the successive isoquants.

Causes of decreasing returns to scale

This arises due to certain diseconomies of a large scale units divided into the internal and external diseconomies.

(1) Internal diseconomies of scale

a) Indivisibility of the entrepreneur :

Though all the factors can be expanded in the long run. but the entrepreneurs still remain an indivisible factor. Beyond the certain range of expansion, This may affect productivity if the other supervisors are not equally efficient.

3) Technical difficulties.

Every factor as an optimum capacity to work as well as an optimum combination with the other inputs. If this proportion can gets imbalance at any stage of production. Decreasing returns may arise in the long run production f^n.

External diseconomies
which are found, to affect productivity in the long run;

① Scarcity of essential inputs
② Rise of cost of factors. when many other industries also complete for the same in the long run.

Ques 1

①

Cost of Production

Types of cost

① Actual cost (Or outlay or accounting cost)
It refers to all the direct payments made by the producers to higher the different factors of production.
examples are rent, wages, interest, profit. etc.

② Sunk cost
It refers to that part of the total actual cost of the producer which is invested in lump sum and is gradually recovered in the production process.
examples are:- fixed cost, depreciation charges etc.

③ Fixed cost and Variable cost
In this fixed cost refers to the cost of the fixed factors of production which remains independent of the level of output produced.
Ex- rent, intrest, salary of permanent Employees.
~~In this~~ variable cost refers to the cost of the variable factors of production which remains independent of the level of output produced. Ex - wages, profit.

Scanned by CamScanner

4. Explicit and implicit cost

Explicit cost refers to the actual cost of the producer

Implicit cast refers to the cost of all the factors which are own and invested by the producer in his own interprise.

It is equivalent to the earning of this factors which is forgonn by the producer

(5) Opportunity cost

It refers to the minimum amount which has to be paid to a factor to be able to higher and retain it in once own enterprise.

It is equivalent to the earning of that factor from the next best alternative

(6) Private cost and social cost

Private cost refers to the cost encour by the producer in undertaking the production process. ex- wages, rent.

Social cost refers to all the indirect cost (+ve or -ve) ~~of~~ which the production process puts on the society for which the producer is not compensated or is not made liable to pay. ex- pollution (-ve)

schools (+ve)

Cost function

of the producer

The cost function can be expressed as

$C = F(S, X, PF, T \ldots)$ where S = size of the plant, X = level of output,

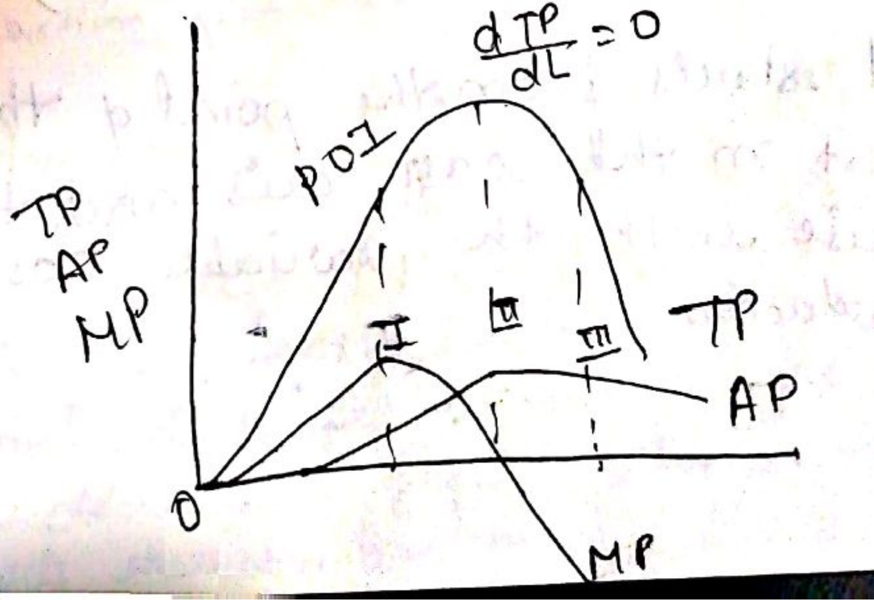
T = Technology/Techiques of production.

PF = price of inputs.

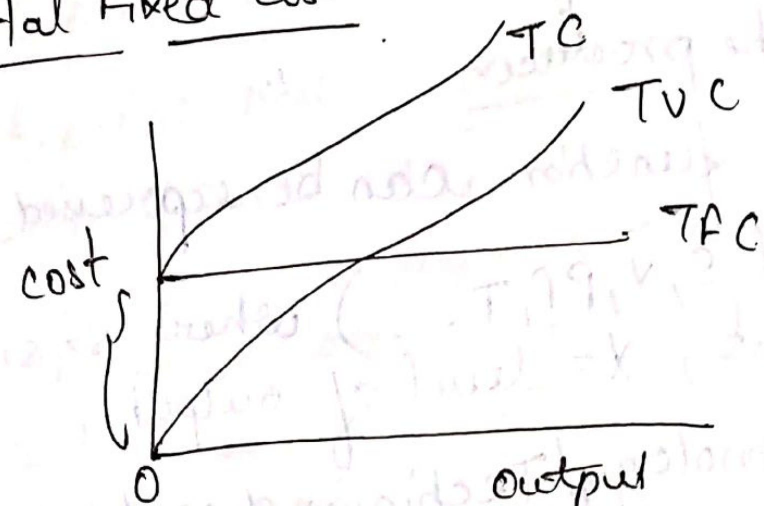
Concepts of Cost of a producer

Output	Total fixed cost	Total Var cost	T cost	Avg Fixed cost	Avg Var cost	Avg cost	Marginal cost
0	1000	0	1000	-	0	-	
10	1000	400	1400	140	40	180	
20	1000	700	1700	85	35	120	
30	1000	930	1930	64.3	31	95.3	
40	1000	1100	2100	52.5	27.5	80	
50	1000	1400	2400	48	28	76	
60	1000	1900	2900	48.3	31.66	79.96	
70	1000	2500	3500	50	35.71	85.71	

Cost Variation in the short run



Total fixed cost



The total fixed cost will be a horizontal line to the output axis as it remains independent of the level of production.

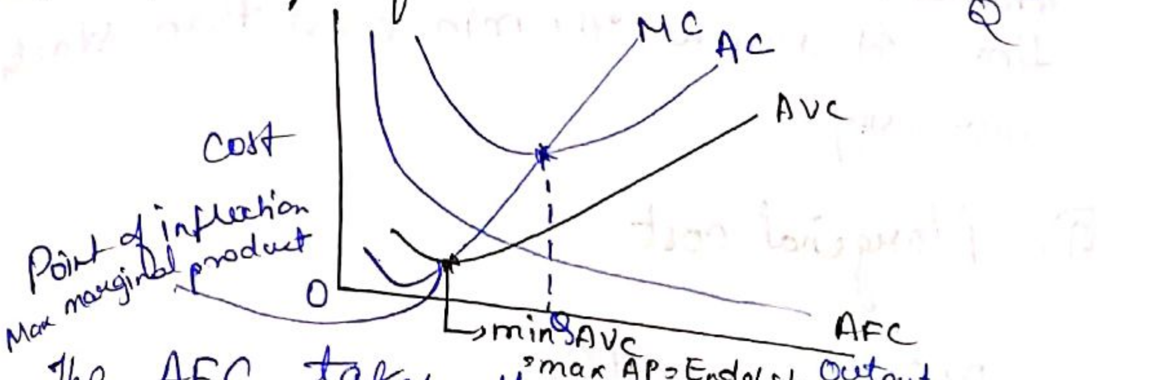
Total variable cost

The TVC varies inversely with the total product in the short run, it initially increases at a decreasing rate and beyond the point of inflection (POI) it starts increasing at an increasing rate.

The Total cost (TFC+ TVC)

It starts from the point of the fixed cost on the cost axis and thereafter rise with the variable cost of production

4. Average fixed cost (AFC) - $\frac{TFC}{Q}$



The AFC takes the shape of the rect hyperbola as the constant fixed cost gets distributed over larger and larger units of output.

5. Average variable cost

$$AVC = \frac{TVC}{Q} = \frac{wL}{Q} = \frac{w}{Q/L}$$

$$= \frac{w}{AP_L} = w\left(\frac{1}{AP_L}\right)$$

The AVC varies inversely with the avg product in the short run prodn fn. it initially dec, reaches the min at the end of stage I in the short run production function.

6 $\text{Avg cost} = \frac{TC}{Q} = \frac{TFC+TVC}{Q}$

$$AC = AFC + AVC$$

The avg cost takes a U shape. It initially decreases as both The AFC and AVC are declining. beyond stage (1), the AVC starts increasing but the rapid decline in the AFC makes the AC to decline for some more time. It reaches the min and then starts increasing

⑦ Marginal cost

$$MC = TC_n - TC_{n-1}$$
$$= (TFC + TVC_n) - (TFC + TVC_{n-1})$$
$$= TVC_n - TVC_{n-1}$$

$$MC = \frac{\Delta TVC}{\Delta Q}$$
$$= \frac{w \Delta L}{\Delta Q} = w \frac{1}{\Delta Q / \Delta L}$$

The marginal cost varies inversely with the marginal product in the short run. It initially decreases, reaches the min at the point of inflection and thereafter starts increasing, passing through a min of both the AVC and AC.

I MC = min AVC ⇒ Why?
∵ It represents end of st-1 in SRPF when AP = MP

As $AVC = \frac{1}{AP}$ & $MC = \frac{1}{MP}$
MC = min AVC

II $MC = \min AC \Rightarrow$ why

$$TC = C$$

$$AC = \frac{C}{Q}$$

$$\frac{dAC}{dQ} = \frac{Q\frac{dC}{dQ} - C}{Q^2}$$

$$= \frac{1}{Q}\left(\frac{dC}{dQ} - \frac{C}{Q}\right)$$

$$= \frac{1}{Q}\left[MC - AC\right]$$

Now Assuming $Q > 0$

(i) when $MC < AC$, $\frac{dAC}{dQ} < 0$ (declining)

(ii) when $MC = AC$, $\frac{dAC}{dQ} = 0$ (Min)

(iii) when $MC > AC$, $\frac{dAC}{dQ} > 0$ (rising)

Ques

$$TC = 100 + 50Q - 12Q^2 + Q^3$$

$$AC = \frac{TC}{Q}$$

$$AC = \frac{100}{Q} + 50 - 12Q + Q^2$$

$AC =$ ~~10+50-1.0~~

$$= 10 + 50 - 120 + 100$$

$$AC = 40$$

$TVC = 50Q - 12Q^2 + Q^3$

$AVC = \frac{TVC}{Q} = 50 - 12Q + Q^2$

$= 30$

$TVC = 50 - 12Q^2 + Q^3$

$\frac{\partial TVC}{\partial Q} = 50 - \cancel{12}\,24Q + 3Q$

$= \cancel{50 - 12 + 20}$

$= 50 - 24Q + 3Q^2$

$= 50 - 240 + 300$

$= 110$

(2)

$AC = \frac{200}{y} - 6y + 8y^2$

$TC = 200 - 6y^2 + 8y^3$

(i) $TFC = 200$

(ii) $AVC = -6y^2 + 8y^3$

$\frac{\partial AVC}{\partial y} = -12y + 24y^2$

$24y^2 - 12y = 0$

$y(24y - 12) = 0$

$24y = 12$

$y = \frac{1}{2}$

(vi) (v) $-6y+8y^2$

$-6+16y$

$16y = 6$

$\boxed{y = \frac{3}{8}}$

(iii) $\cancel{TVC = -6y+8y^2}$

$\cancel{= -6+8y}$

$\cancel{-6+32 = }$ 336

$TVC = -6y^2+8y^3$

$\frac{\partial TVC}{\partial q} = -12y+24y^2$

$= \cancel{(-12)(4)+(24)}(4)$

$= -\cancel{48+16}$

$= (-12)(4)+(24)(16)$

$= -48+384$

$= 336$

Scanned by CamScanner

③ $TC = 400 + 30x - 12x^2 + x^3$ ④

$TVC = 30x - 12x^2 + x^3$

$AVC = \cancel{30 - 24x + 3x^2}$

$30 - 12x + x^2$

$\frac{\partial AVC}{\partial x} = \cancel{30 - 24 + 6x}$

$\cancel{x = -1}$

min MC

$MC = \cancel{30} - 24x + 3x^2$

$\frac{\Delta MC}{\Delta x} = \cancel{30} - 24 + 6x$

$= \cancel{30}\ 6x = 24$

$\boxed{x = 4}$

(ii) End of Stage I

min AVC or AVC = MC

$\cancel{AVC = 30 - 24x + 3x^2}$

$\cancel{\frac{\partial AVC}{\partial x} = -24 + 6x}$

$AVC = 30 - 12x + x^2$

$\frac{\partial AVC}{\partial x} = -12 + 2x$ $\boxed{x = 6}$

(4) (i) $TC = 27\sqrt[3]{x^2}$

$1-\frac{2}{3} = \frac{1}{3}$

$TVC = 27\sqrt[3]{x^2}$

$MC = \frac{\partial TC}{\partial x}$

$= 27\,x^{\frac{2}{3}}$ $\quad x^{\frac{2}{3}}$

$= \cancel{27}^{9}\,\frac{2}{\cancel{3}}(x)^{-\frac{1}{3}}$

$MC = \frac{18}{3} = 6$

(ii) $MC = 0.6x^2 - 2x + 5$ $\quad x = 10$

$TFC = 1000$

$TC = TVC + TFC$

$TVC = \int 0.6x^2 - 2x + 5$

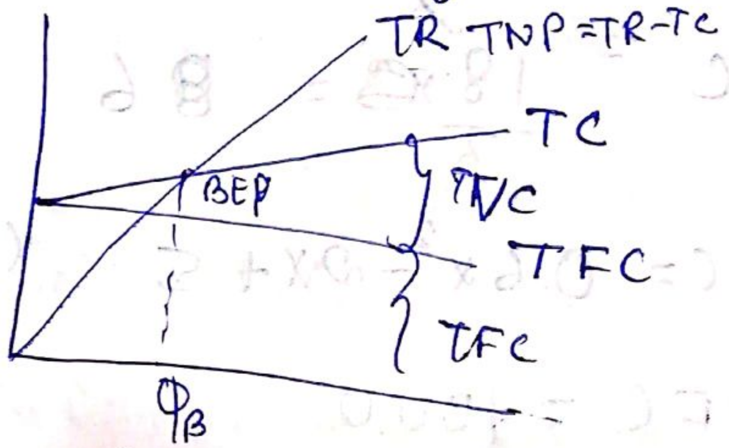
$TC = 0.6\frac{x^3}{3} - \frac{2x^2}{2} + 5x + C$

$= 0.6\frac{(10)^3}{3} - \frac{2(10)^2}{2} + 5(10) + 1000$

$=$

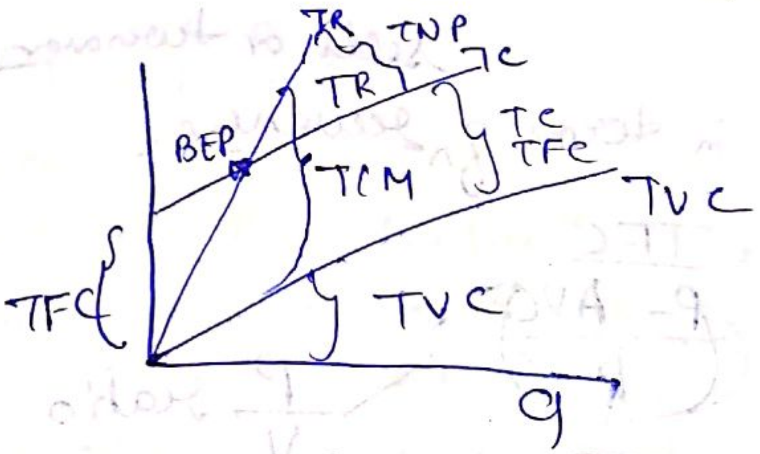
Break Even Analysis

The break even point of a producer represents the point where he equilises his total revenue with the total cost of investment.
in other words it is the min level of output which has to produce by a producer to be able to sustain in the industry in the long run.



Total net profit = TNP ⇒ π = TR-TC
Q_B

Total contributory Margin. (TCM)
In the short run where a major component of the producer's total total cost is the form of sunk investment, it evaluates its profit in the form of total contributory margin which refers to the revenue of the producer over the variable cost of production.



$$TCM = TR - TVC$$
$$= TR - (TC - TFC)$$
$$= (TR - TC) + TFC$$
$$= TNP + TFC$$

At BEP, $TNP = 0$

$$TCM = TFC$$

Derivation of Break even point

I. BEP in terms of output

at BEP $\Rightarrow$ $TR = TC$

$$P \times Q_B = TFC + TVC$$
$$P Q_B = TFC + Q_B (AVC)$$
$$Q_B = \frac{TFC}{P - AVC}$$

P – price

Note – $TCM = \frac{TR}{Q} - \frac{TVC}{Q}$

$ACM = P - AVC$

Avg contributory margin.

sells or turnover on

II BEP in terms of revenue.

$$S_B = \frac{TFC}{\left(\frac{P - AVC}{P}\right)}$$

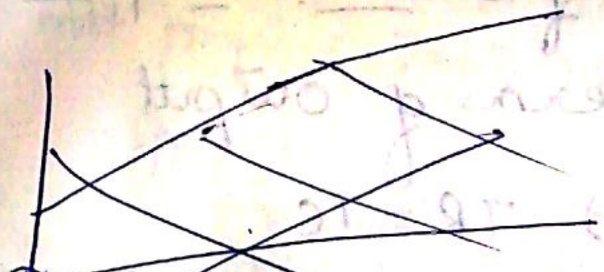
P/V ratio

$$S_B = \frac{TFC}{\left(\frac{TR - TVC}{TR}\right)}$$

$$S_B = \frac{TFC}{P/V \text{ ratio}}$$

BEP with target profit

π = targeted profit



Margin of Safety

The margin of safety of a producer measures the distance between the actual production and the break-even production of a producer.

Higher the margin of safety more is the efficiency of the producer and vice versa.

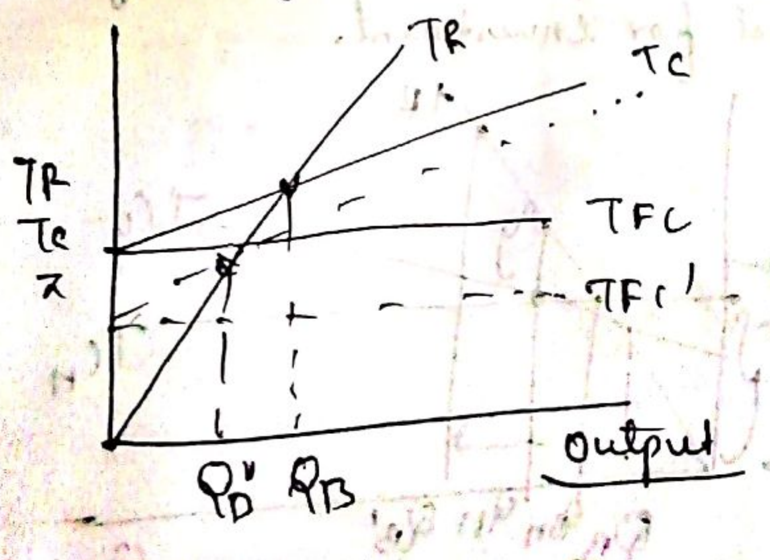
$$\underset{\text{(in output)}}{MOS} = \left[\frac{Q_S - Q_B}{Q_S}\right] \times 100$$

MOS (in sale) = Total Sale − Break even sale (S_B)
(in terms of revenue)

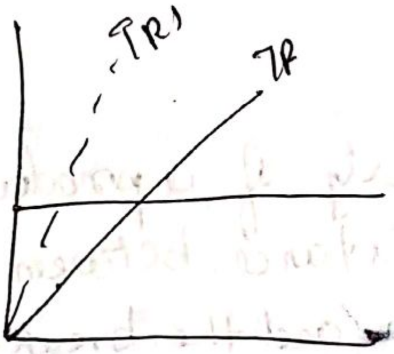
Methods of reducing the break even point

① A lower BEP is desirable because it signifies quicker recovery of the total cost of production. ~~SO~~

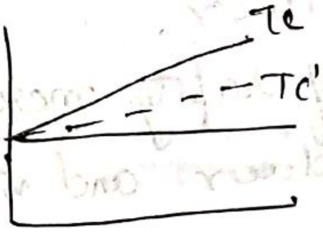
① Reducing TFC
② Increasing the price per unit
③ Reducing the AC.



ii



iii

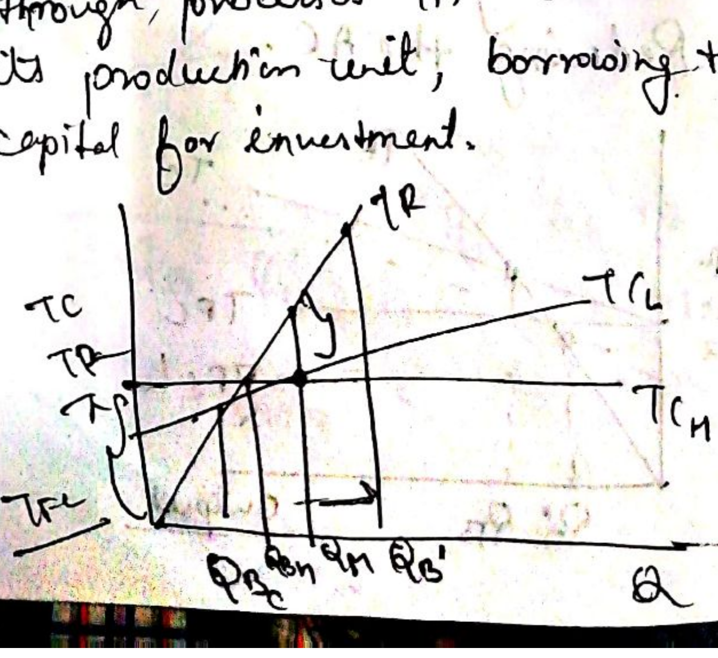


Operating leverege

$$OL \Rightarrow \frac{TFC}{TVC}$$

Operating leverage refers to the ratio between the total fixed cost and the total variable cost of a production unit. Higher the ratio more highly leveraged a firm is and vice versa.

A firm can become a highly leveraged by increasing its fixed cost component through processes like automation of its production unit, borrowing the capital for investment.



A highly leveraged firm have more sensitivity of profit with any change in output in the long run because it experiences lower variation in their total cost of production relative to a low levareg producer.

Qus 2

$BEP = 5000$ $\qquad \pi = 25000$

$TFC = 50000$

$AVC = 25$

$$Q_B^{\pi} = \frac{TFC + \pi}{P - AVC}$$

$$Q_B = \frac{50000}{P - 25}$$

$5000P - 125000 = 50000$

$P = 35/-$

$$Q_B' = \frac{50000 + 25000}{35 - 25}$$

$= 7500$

Ques 2

$TC = 3000 + 5x$

$TR = 30x$

$P = 30$

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

$TVC = 5x$

(i) $$Q_B = \frac{3000}{30 - 5} = \frac{300}{25} = 12$$

$\pi = TR - TC$

(ii) $TCM = TR - TVC$

$TCM = TNP + TFC$

$Q_B = 50$

$TNP = P_{20}M$

~~TFC + TVC = TR~~

~~TCM~~ $300 = TMP +$

$TR - TVC = TNP + TFC$

$30x - 5x = TMP + 300$

$TMP = 950$

(3)

$TFC = 4500$

$TVC = 7500$

$Q = 5000$

$S_B = 15000 = TR$

(i) $TCM = TR - TVC$

$= 15000 - 7500$

$= 7500$

(ii) ~~$S_B = \frac{4500}{\frac{7500}{15000}} = \frac{4500}{\frac{75}{150}} = \frac{4500 \times 150}{75}$~~

7500

(ii) $Q_B = \frac{TFC}{P - AVC}$

$= \frac{4500}{3 - 1.5} = 3000$

MOS = Total sale − S_B

in terms of ~~sale~~ ~~turnover~~ sale turnover ~~MOS =~~

$= 15000 - 9000$

$= 6000$

in terms of output

$MOS = \frac{Q_s - Q_B}{Q_s} \times 100 = 40\%$

$Q_B = 5000$

(iii) Profit = TR − TC

(iv) $S_B' = \frac{TFC + \text{Profit}}{\frac{TR - TVC}{TR}}$

$S_B' = \frac{4500 + P}{\frac{7500}{TR}} = \frac{10500}{0.5}$

$S_B' = 21000$

(4)

TFC = 60000

AVC = 10

P = 20

Q = 10000

$$MOS = \frac{Q_S - Q_B}{Q_S} \times 100$$

$$Q_B = \frac{TFC}{P - AVC}$$

$$= \frac{60000}{20 - 10} = 6000$$

$$MOS = \frac{4\cancel{000}}{10\cancel{000}} \times 100$$

$$= 40\%$$

$MOS = Q_B \times P - Q_S P$

in sell turnover = 12000 − 200000

(5)

$$\frac{Q_S - Q_D}{Q_S} \times 100 = \frac{40000}{\quad}$$

40 , 66.66

The second producer is more efficient because it have higher MOS.

Scanned by CamScanner

Types of Market And its equilibrium

A market is defined as any contact between the buyers and the sellers which facilitates the exchange of goods and services.

1. No. of buyers & sellers
2. Types of product sold

Perfect Competition

Features

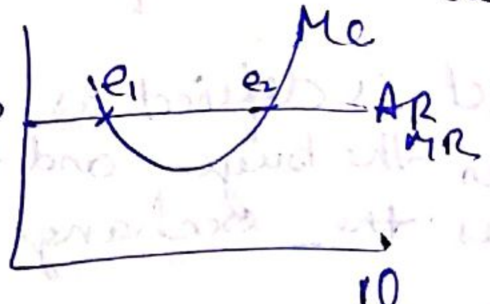
1. There are large no. of buyers and sellers in the market.
2. All the product sold under PC are exactly identical or homogeneous in nature.
3. There is free entry and exit of firms in and out of industry.
4. There is no interdependence among the firms under perfect competition.
5. There is perfect knowledge among the buyers and sellers about the price condition prevailing the market.
6. In such type of market ones the price is determine by the equilibrium of the industries demand and supply, every producer working it will have to face a

perfectly elastic demand curve at the prevailing price level.

$TR = p \times q$

$AR = \frac{p \times q}{q} = P$

$MR = \frac{\partial TR}{\partial q} = P$



Equilibrium and profit maximizing condition:-

$(TNP) = \pi = TR - TC$
(profit)

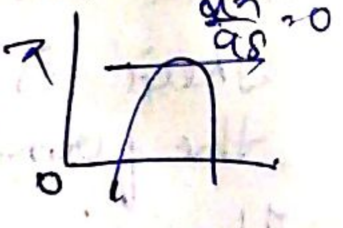
$$\frac{d\pi}{\partial q} = 0$$

$$\frac{\partial TR}{\partial q} - \frac{\partial TC}{\partial q}$$

$MR - MC = 0$ Marginal cost

$\underline{MR = MC}$

$$\frac{d^2\pi}{dq^2} < 0$$



A producer will maximize his profit at the point where

① He equalizes the marginal revenue with the marginal cost of production.

② The marginal cost must be increasing

faster than the marginal revenue at the point of equilibrium.

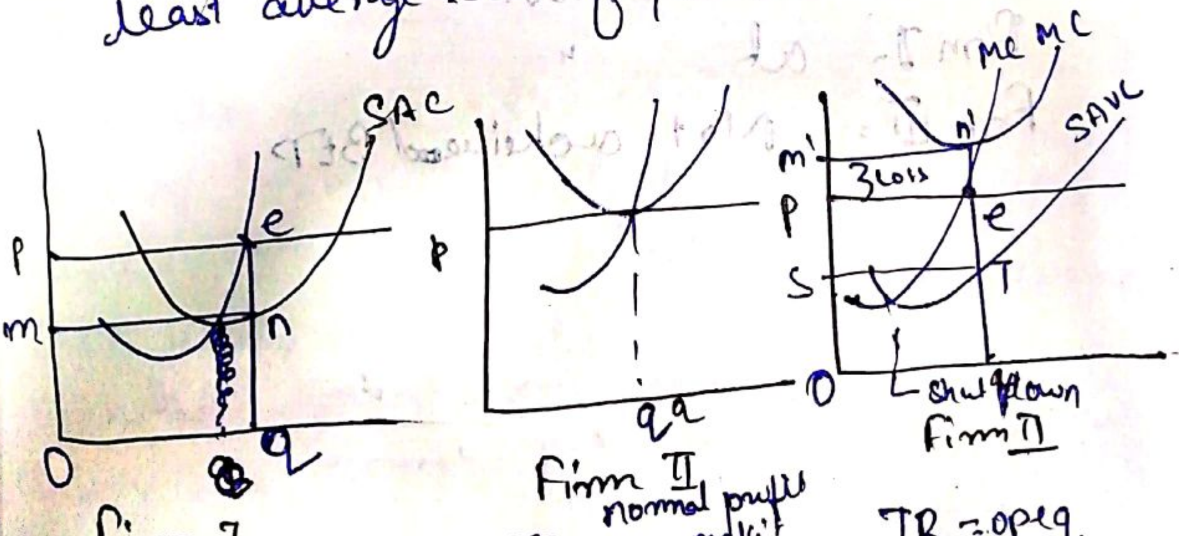
Short run equilibrium Under Perfect Competition

As the same demand condition prevails for all the producers under perfect competition, it is their differential cost conditions which will determine their profit and loses.

The differential cost conditions may arise due to factors like (1) the location of the production unit from the source of raw material and the market.

(2) The price at which they get their input, the efficiency of entrepreneur and other skilled factors etc. ~~AC should~~

(3) The most efficient firm will have the least average cost of production and viceversa.



Firm I

π, TR − TC = opeq

~~TR = OPEQ~~

TC = om × OQ

= omnq

TR > TC

Firm II

normal profit

make unit

no profit

no loss

Firm III

TR = opeq

TC = om'n'q

TC > TR

~~TC = TFC + TVC~~

π Pm'n'e

TC = TFC + TVC

= Sm'n'T + OSTQ

A loss making unit will remain in prod^n
So long as
price > min AVC.
by doing so it will cover its total variable cost including a part of the fixed cost of prod^n. The firm will shut down and quit the industry at the point where the price = min AVC.
By shutting down the variable cost will be zero and loses will be only the fixed cost of production.

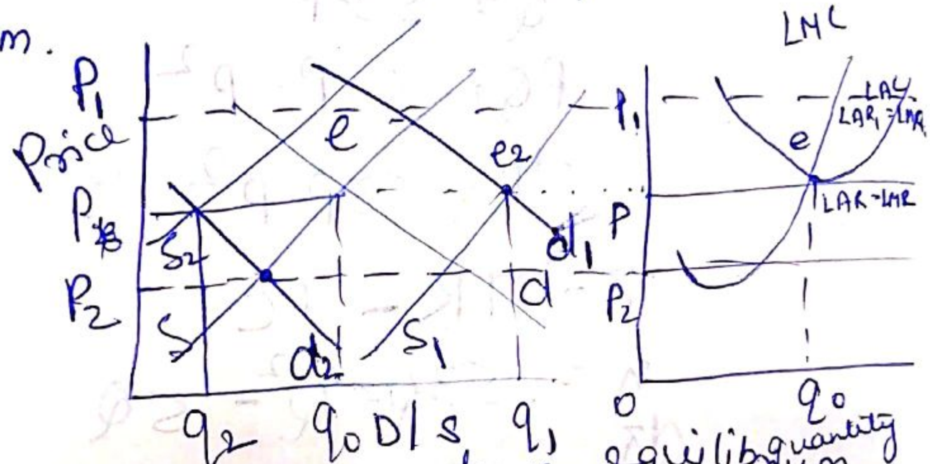
P = min AVC
or
min AVC
or
MC = AVC

Firm I - achieved BEP
Firm II - at "
Firm III = Not acheived BEP

Long Run Equilibrium Under Perfect comp

In the long run the industry will be in equilibrium where all the producers working under it just makes normal profit at the prevailing price level.

If there is any deviation from the equilibrium price, with free entry and exit, the market has the ability to generate forces which will reverse the price back to equilibrium.



If the price increases above equilibrium due to increase in demand, many producers will make more than normal profit. This will attract new producers into the market, which will increase the supply and reverse the price back to equilibrium.

$D\uparrow \to P\uparrow \to \pi\uparrow \Rightarrow S\uparrow = \downarrow P$ (Price)

$D\downarrow \to P\downarrow \to \pi\downarrow \Rightarrow S\downarrow = \downarrow P$ back to equil.

loss and they leave the market

Ques $TC = 5Q$

$Q = 53 - P$

find the output where maximum profit.

$TFC = 5Q$

(1) $\pi = TR - TC$

$Q = 53 - P$

$PQ = 53P - P^2$

$TR = 53P - P^2$

$\pi = TR - TC$

$\pi = 53Q - Q^2 - 5Q$

$\frac{d\pi}{dQ} = 53 - 2Q - 5$

$48 = 2Q$

$Q = 24$ units

(ii) approach $MC = MR$

Ques(2) $TR = 200q - 0.01q^2$

$\pi = 200q - 0.01q^2 - 50q - 20000$

$\pi = 150q - 0.01q^2 - 20000$

$\frac{d\pi}{dq}$

(3)

(4)

Scanned by CamScanner

$$\frac{d\pi}{dq} = 150 - 0.02q$$

$$= 150 - (0.02)q = 0$$

$$0.02q = 150$$

$$2q = 15000$$

$$q = 7500$$

$\pi = 542500$ (putting in π f^n)

(3)

$$C = \frac{1}{3}q^3 - 2.5q^2 + 6q$$

$$AVC = \frac{1}{3}q^2 - 2.5q + 6$$

$$\frac{dAVC}{dq} = \frac{2}{3}q - 2.5$$

$$\frac{2}{3}q = 2.5$$

$$q = \cancel{\frac{7.5}{2}}\ 3.75$$

$$AVC = \cancel{\frac{1}{3}(3.75)^2 - 2.5(3.75) + 6}$$

~~min AVC = 1.3125~~

(4)

$$TC = 6000 + 400Q - 20Q^2 + Q^3$$

$$TFC = 400Q - 20Q^2 + Q^3$$

$$AVC = 400 - 20Q + Q^2$$

$$= 400 - 200 + 100$$

min AVC = $\underline{300}$ = P

(ii) P > min AVC so it can continue

Ques(5) D : $X = 200 - 10P$

$C = 10X + \frac{X^2}{25}$

$\frac{x^2}{25} - 10x$

$\frac{499x^2}{25}$

(i) Profit = TR − TC

$= \cancel{200X - 10X^2 - 10X + \frac{X^2}{25}}$

$= \cancel{190X - \frac{499}{25}X^2}$

$= \cancel{190 - \frac{2(499)}{25}X}$

$190 = \frac{2(499)}{25}X$

$\cancel{\frac{190 \times 2}{499} = X}$

$X = 0.76$

Profit $= \cancel{(200)(0.76) - 10(0.76)^2 - 10(0.76) + \frac{(0.76)^2}{25}}$

$= \cancel{190(0.76) - \frac{499}{25}(0.76)^2}$

$= \cancel{144.4 - 11.52}$

$= \cancel{132.87}$

$P = \frac{250}{7}$