Economic

It is a social science which study human behavior

Texms

- Nature and scope of engineering economic
- Theory of consumer behaviour
- Demand
- Supply
- Revenue
- Elasticity of demand and supply.
- Interest Rate
  - simple Interest Rate (Interest is calculate one time in a year)
  - compound " "
  - Nominal " " (several time in a year)
  - Effective " "

$$D_x = P_x Q_x$$

$$D_x = f(P_x)$$

$$Q_{(x)} = f(D_x)$$

- Compound Amount factor
- comparison of Alternative
- production
- cost
- Market
- Depreciation
  - Straight line method
  - Declining balance "
  - sum of-the-years-digit method
  - Sinking fund method
- Inflation

Defination of Economic father → Adam smit

According to Adam smith, he defined economic as a subject which inquries into the nature and causes of wealth of the nation.

According to Robbines.

he defined economic as a science which study human behaviours as a relationship between ends and scarce means which have alternative useys.

Engineering Economics (levin)

He defined engineering economic as that branch of economic which deals with method that can enable one to make economic decision tow-ards the evaluation of engineering Alternative

Nature of engineering Economic

What to produce ?
How to produce ?
For whome to be produced ?
Economic growth problem.

Scope of Engineering Economic.

It is wide theory of consumer behaviour elasticity of demand, demand, elasticity of supply, supply revenue, equality on between demand and supply; Interest rate, compound amount factors comparison of alternatives production cost market depreciation and impreciation

Demand

It refers to the effective desire to have some that the b the ability and willingness to pay for it.

Demand Schedule.

It refers to the tabular representation of the different quality of ~~co~~commodity demand at different price at given point of time

price of x	Q. D of x
100	1
90	2
50	4
40	6

Types of Demand Schedule.

(I) Individual Demand

It refers to the tabular representation of different quantity of a commodity (goods) by individual consumer at different price at a given point of time

price of x	D.D of x
100	2
80	3
50	4
25	6

(II) Market demand schedule.

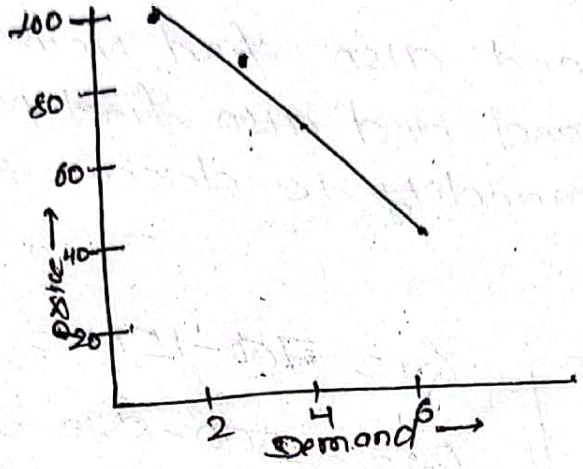
It refers to the tabular representation of different quantity of commodity in the market at different price at a given point of time.

price of x	Consumer A	Consumer B	Consumer C	Market demand
40	1	2	4	7
30	2	5	8	15
20	3	8	13	25

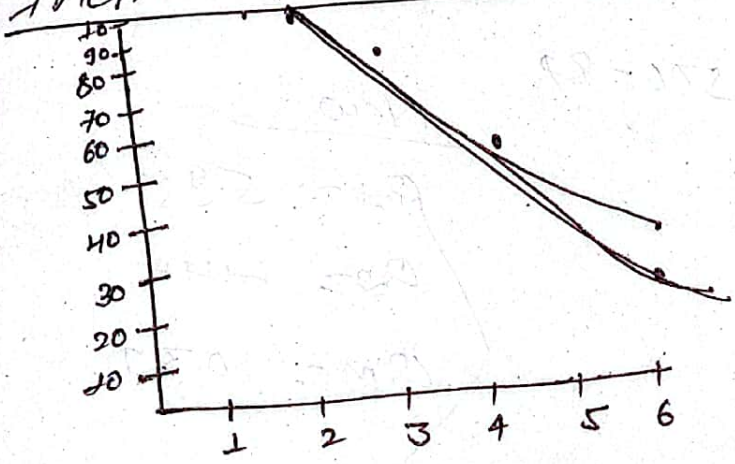
* Market demand = Horizontal sum of D.D of customer.

Demand curve.

It refers to the graphical representation of demand schedules.



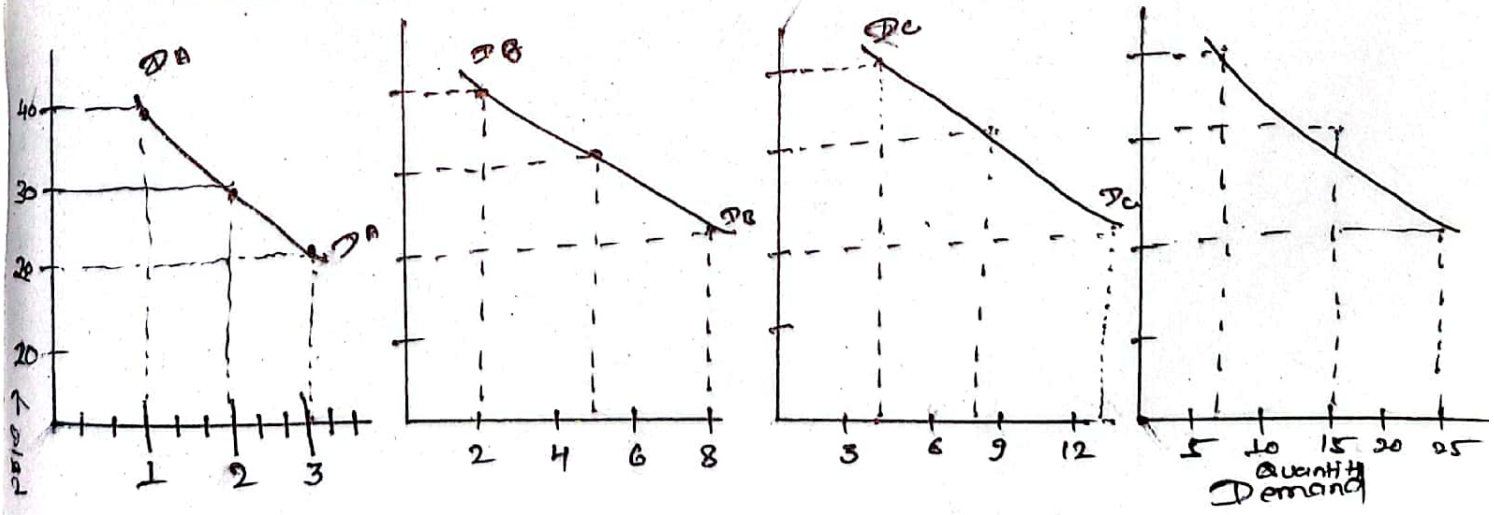
Individual Demand curve.



Market demand curve.

Individual demand for consumers A B C

Market demand



From the following individual demand function find out market demand function find quantity demand for the commodity by the individual consumer and market demand if price of the commodity is Rs 10/unit and also find new individual quantity demand and also ~~find~~ Market demand if price of commodity is decrease to Rs 7/unit.

$Q_1 = 700 - 15P$

$Q_2 = 500 - 8P$

$Q_1 = 700 - 15 \times 10 = 550$

$Q_2 = 500 - 8 \times 10 = 420$

$Q_M = Q_1 + Q_2$

$= 700 + 15P + 500 - 8P$

$= 1200 - 23P$

$= 970$

New

$Q_1 = 595$ (Rs=7)

$Q_2 = 444$

$Q_M = 1039$

~~for Rs 10~~

~~$Q_1 = 1200 - 23P = 1200 - 23 \times 10 =$~~

$Q_1 = 700 - 15 \times 7 = 595.$

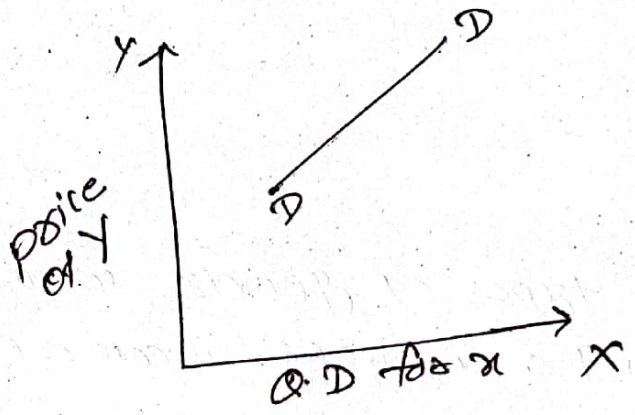
Types of goods

(i) Substitute & complimentary goods

(ii) Normal goods & inferior goods.

Substitute goods

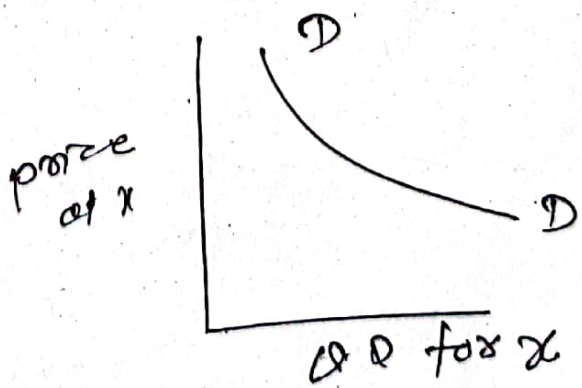
It refers to those types of goods where with the increase in price of one goods quantity demand for other goods decrease, eg:- bus transport, tea, coffee.



Complimentary goods.

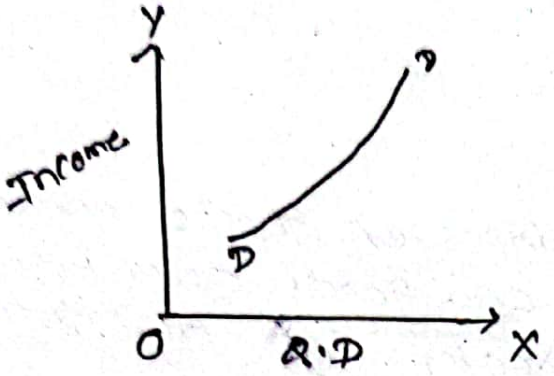
It refers to those types of goods where with the increase in price of one goods quantity demand for other goods decrease

eg:- car & petrol



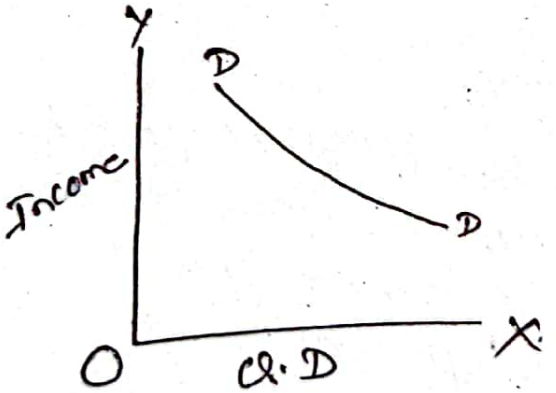
Normal goods

It refers to those types of goods whose quantity demand increase with increase income of the consumer



Inferior goods

It refers to those types of goods whose quantity demand decline with increase income of the consumer



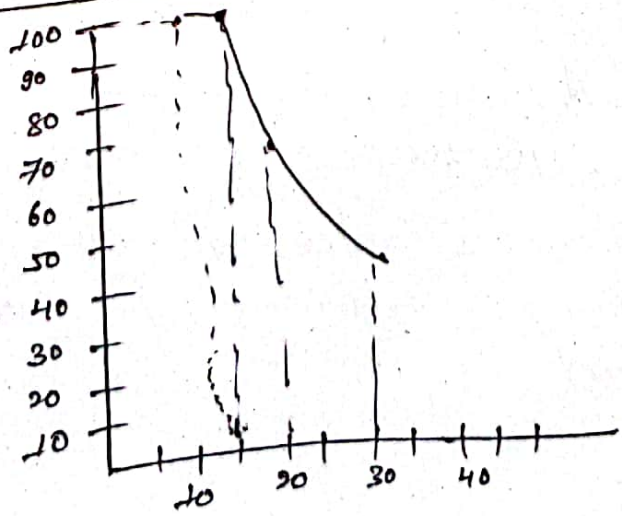
Law of Demands.

We defined the Law of demands are other things remaining constant (ceteris paribus) quantity demand for a commodity increase with a fallen prices and decrease with in its price.

Assumptions of Law.

(I) Income of the consumer remains constant
(II) Prices of related goods do not change
(III) Taste and preference of the consumer remain constant
(IV) No. of consumers in the market remain constant
(V) The goods should be a normal good.

price of x	D x
100	15
70	20
50	30



criticism / Limitation of law of demands/ exceptions of the law of demand.

1. Giffen good
2. Veblen "
3. speculation
4. work & emergency
5. other factors.

change in Demand & change in quantity demand

when demand for a commodity changes due to change in other factor price remains constant it is called change in demand.

Types of change in demand

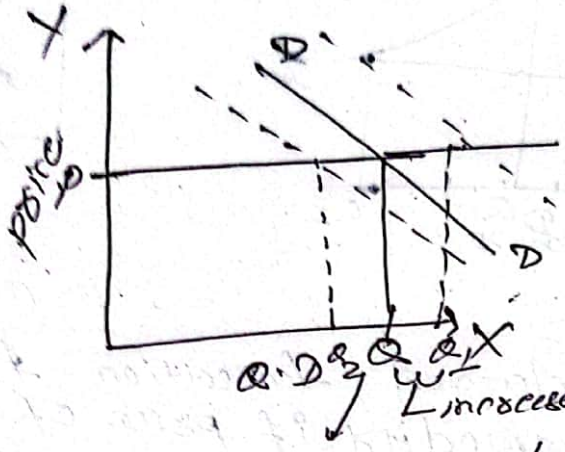
(I) Increase in demand.
(II) Decrease in demand

(I) Increase in demand

when a consumer purchases is more of a commodity then before due to change in other factors price remaining constant it is called increase in demand

Decrease in demand

when a consumer purchase less of a commodity then before due to change in other factors price remaining constant it is called decrease in demand.



change in quantity demand

when demand for commodity changes due to change in price other factor remaining constant it is called change in quantity demand.

Types of change in quantity demand

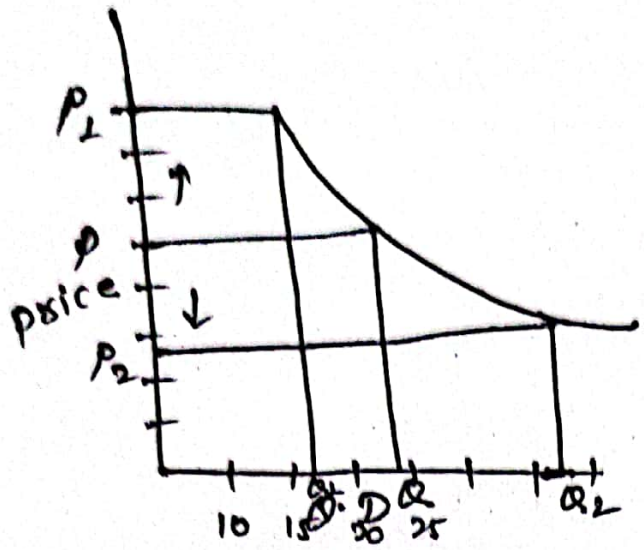
(i) extention in demand
(ii) contraction in demand

Extention in demand

when demand for a commodity increase due to fall in it's price other factors remaining constant it is called extension in demand

contraction in demand

when demand for a commodity decrease due to raise in it's price other factors remain remaining constant it is called contraction in demand.



price	Q. Dem
100	10
90	15
80	25

3. From the following demand function find out quantity demand for the commodity if price of commodity per unit is Rs 20 and monthly income of consumer is Rs 45,000/-

$$Q = 20{,}000 - 10P + 0.2Y$$

(Q: quantity, P: price, Y: income)

Find out new quantity demand for the commodity if price of commodity decrease to Rs 15/unit income remains constant and also find out what type of change in quantity

$$Q = 20000 - 10 \times 20 + 0.2 \times 45000$$

$$= 20.000 - 200 + 9000$$

$$= 28800$$

$$Q_{new} = 20000 - 10 \times 15 + 0.2 \times 45000$$

$$= 2000 - 150 + 9000$$

$$= 28850$$

Determinants of Demand / Factors Affecting Demand

(I) Income of the consumer
(II) prices of related good
(III) Test and pref
(IV) No of consumers in the market
(V) Seasonal demand
(VI) Government policy
(VII) Wealth distribution.
(VIII) Advertisement

Elasticity of Demand

It refers to the degree of change of quantity demand of a commodity in response to change its due to price.

Types of elasticity of demand

1) price elasticity of demand
2) Income " "
3) cross " "

Price Elasticity of demand

It refers to the degree of responsiveness of quantity demand due a commodity in response to a change in it's price. of a

$$E(e_p) = \frac{\text{Percentage change in Q.D}}{\text{Percentage change in price}}$$

or

$$= \frac{\text{proportionate change in Q.D}}{\text{change in price.}}$$

$$= \frac{\frac{\text{change in Q.D}}{\text{original Q.D}} \times 100}{\frac{\text{change in price}}{\text{original price}} \times 100}$$

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

$$E(e_p) = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$$

$$E(e_p) = \frac{dQ}{dP} \times \frac{P}{Q}$$ in the calculus form

P	Q
20	50
10	70

if quantity demand for a commodity increase from 200 to 250 units due to fall in its price from 80 to 75 per/unit find out price elasticity of demand.

Sol^{n}

$Q_1 = 200$ $\quad P_1 = 80$ $\quad \Delta P = -5$

$Q_2 = 250$ $\quad P_2 = 75$

$\Delta Q = 50$

$$E(ep) = \frac{50}{200} \times \frac{80}{-5} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \Big| \frac{50}{200} \times \frac{80}{-5}$$

$$= \frac{5 \times 8^{4}}{2 \times 5} \qquad = \frac{80}{-5} \qquad = |-4| = 4$$

from the following demand function find out elasticity of demand if price of commodity is Rs100/units

$Q_x = 30,000 - 10P_x$ $\quad Q_x = 30,000 - 10 \times 100$

$=$

formula $E = \frac{dQx}{dPx} \times \frac{Px}{Qx}$

$= -10 \times \frac{100}{29000}$

Income Elasticity of demand

It refers to the degree of responsive of Q.D for a commodity in response of a change in income of a consumer.

$$e_y = \frac{\text{proportionate change in Q.D}}{\text{proportionate change in income.}}$$

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

$$\boxed{e_y = \frac{dQ}{dY} \times \frac{Y}{Q}}$$

Q) If a consumer purchases a commodity increases from 25 to 40 units due to an increase in his income from 50,000 Rs to 70,000 per month find out income elasticity of demand.

$Q_1 = 25$ $\quad Y_1 = 50,000$

$Q_2 = 40,$ $\quad Y_2 = 70,000$

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

$$= \frac{15}{20,000} \times \frac{50,000}{25}$$

$$= 1.5$$

From the following demand function find out income elasticity of demand if the income of consumer is 15,000 per month

$$Q = 40,000 + 0.6M$$
$$= 40,000 + 0.6 \times 15000$$
$$= 49,000$$

$$E(ed) = \frac{dQ}{dJ} \times \frac{J}{Q}$$
$$= 0.6 \times \frac{15,000}{49000}$$
$$= \frac{4}{49} = 0.18$$

3) Cross elasticity of demand w.r.t to related good.

When two x & y are so closely related that quantity demand for x depends on price of good y then cross elasticity of demand define as the degree of responsiveness of quantity demand for x in response to a change a price of y.

$$e_{cross} = \frac{\text{percentage change in Q.D for } x}{\text{percentage change in price for } y.}$$

$$e_{cross} = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

(P_y — original price; Q_x — original quantity.)

6) if quantity demand for coffee increases from 10,000 units to 15,000 units due to raise in price of Tea from Rs5,000 to Rs8,000 per 250 gm pack find out cross elasticity of demand between tea and coffee.

$Q_1 = 10,000$ $\quad P_1 = 500$

$Q_2 = 15,000$ $\quad P_2 = 800$

$\Delta Q = 5,000$ $\quad \Delta P = 300$

$$e_{cross} = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

$$= \frac{5000}{300} \times \frac{500}{10,000}$$

$=$

from the following demand fun^n find out cross elasticity of demand between tea and coffee if price of tea is Rs17,00 per 500gm packet for this

is $Q = 45,000 + 0.3P_c$

$= 45000 + 0.3 \times 1700$

$= 45000 + 510$

$= 45510$

$$e_{cross} = 0.3 + \frac{\Delta 17000}{45510}$$

$= 0.01$

from the following demand fn find out price elasticity of demand and income elasticity of demand if price of commodity is ~~Rs~~ Rs 30 units per unit and income of consumers is Rs 25,000 per months.

$$Q = 80,000 - 20P + 0.7Y$$

$$= 80,000 - 20 \times 30 + 0.7 \times 25,000$$

$$= \cancel{24900}\ 96,900$$

$$e_p = -20 * \frac{30}{96900} = 0.0061$$

$$e_i = 0.7 \times \frac{2500}{96,900} = 0.18$$

Q) From the following table find out - cross elasticity of demand between good X & Y if price of good X increases from Rs 200 to Rs 400 per unit

- find out good X and Y are what type of good on the bases of above question.
- income elasticity of demand for good Y if income of consumers will increase from Rs 50,000 to Rs 55,000 per months
  good Y of what type of good on the bases of above question.

price of good x	Q.D for good y	Income
200	80	20,000
300	70	40,000
400	65	50,000
500	40	55,000

$$e_{\text{cross for } x} = \frac{\Delta Q_x}{\Delta P_x} \times \frac{P_x}{Q_x}$$

$$= \frac{-15}{200} \times \frac{200}{80}$$

$$= -0.1875$$

$$e_y = \frac{-30}{151000} \times \frac{40,000}{70}$$

$$= -1.142.$$

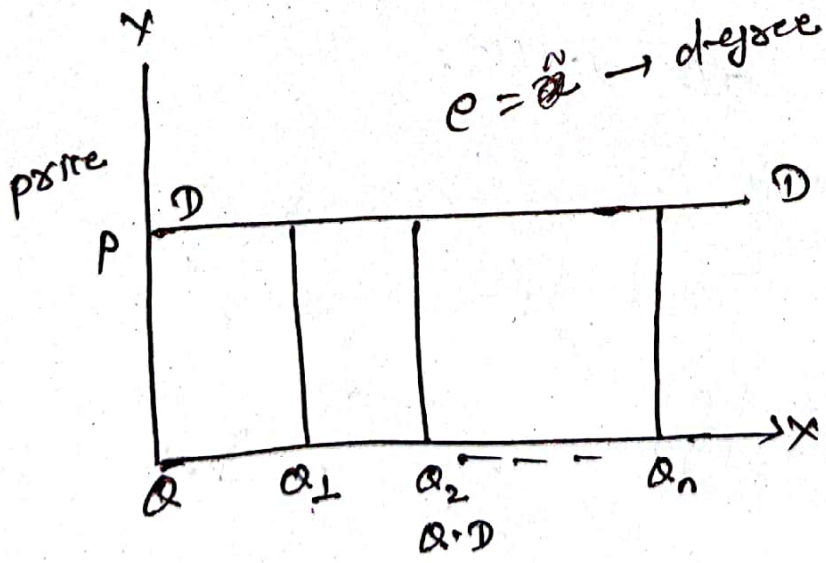
Degree of Elasticity of Demand

1. perfectly elastic demand
2. Relatively " / more elasticity
3. unitary " demand
4. Relatively inelastic / less elastic demand
5. perfectly inelastic demand.

1 perfectly elastic demand

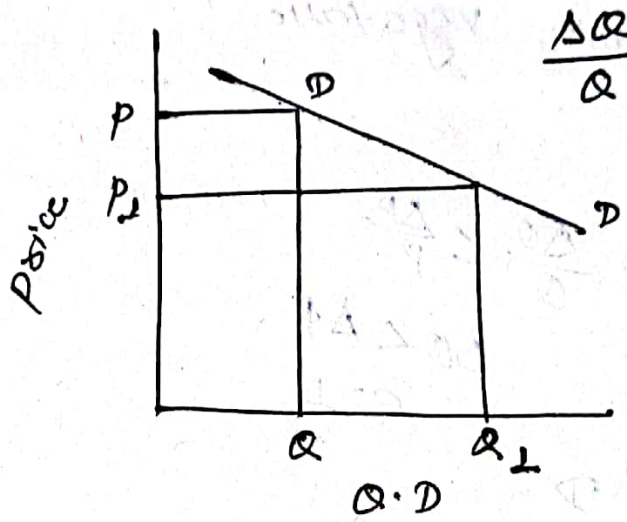
when at a Fixed price infinite quantity of a commodity demanded with a small increase in price quantity demand fall to zero it is called perfectly elastic demand

$e = \frac{\infty}{0}$ → degree of elastic



2 Relatively elastic demand

When there is more than proportionate change in quantity demand in response to a change in its price it is called relatively elastic demand.

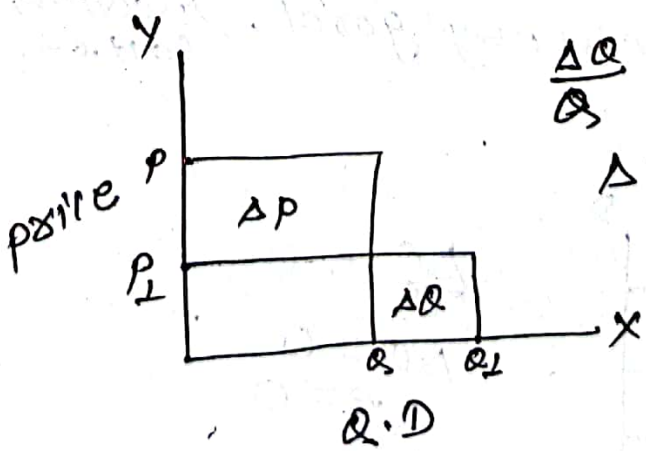


$\frac{\Delta Q}{Q} > \frac{\Delta P}{-P}$ $e > 1$

$\Delta Q > \Delta P$

Unitary elastic demand

When there is proportional change in Q.D



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

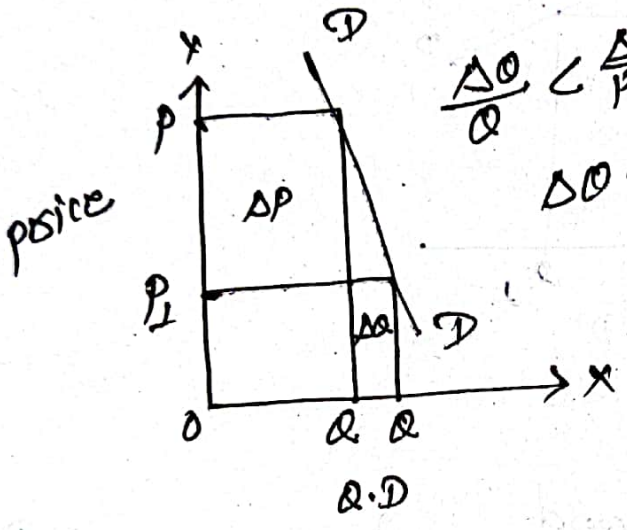
$\Delta Q = \Delta P$

$e = 1$

4) Relatively inelastic demand.

When there is less than proportionate change in a/d for a commodity in response to change in it's price, it is called Relatively inelastic demand.

eg:- perishable, fruits, vegetable



$\frac{\Delta Q}{Q} < \frac{\Delta P}{P}$

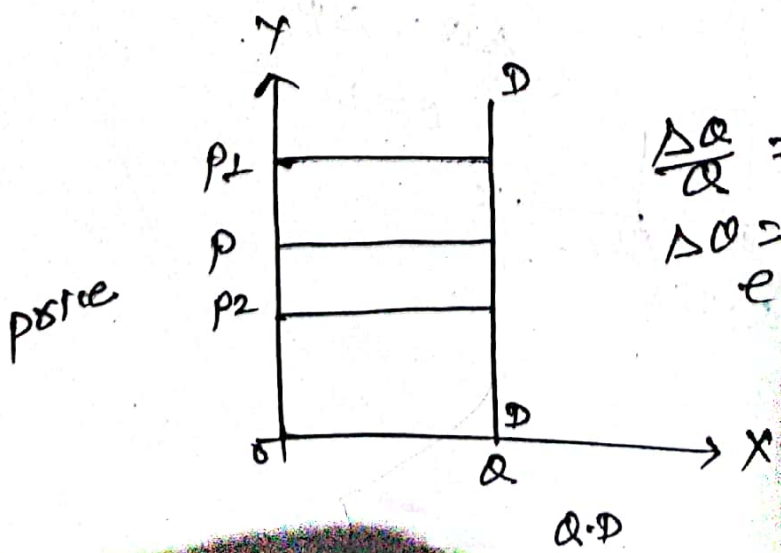
$\Delta Q < \Delta P$

$e = 1$

5) perfectly inelastic demand.

When there is no change in quantity demand for a commodity in response to any change in it's price it is called perfectly inelastic demand.

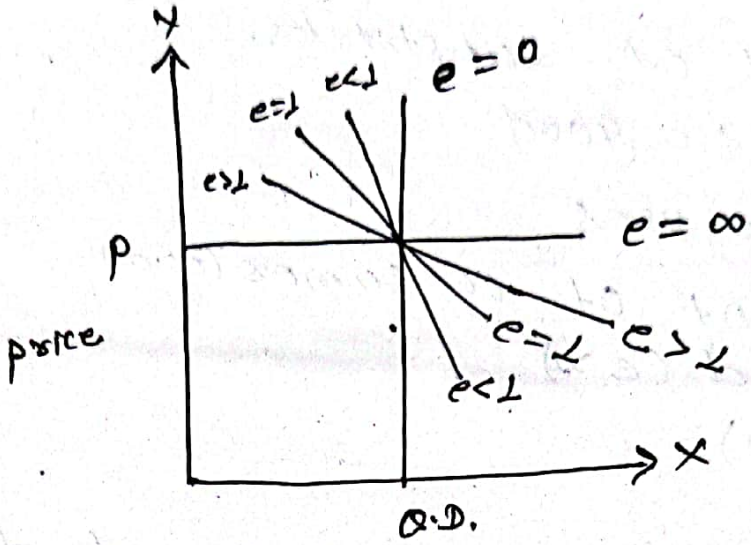
eg:- All types of necessary good, vaccine, milk, salt, etc



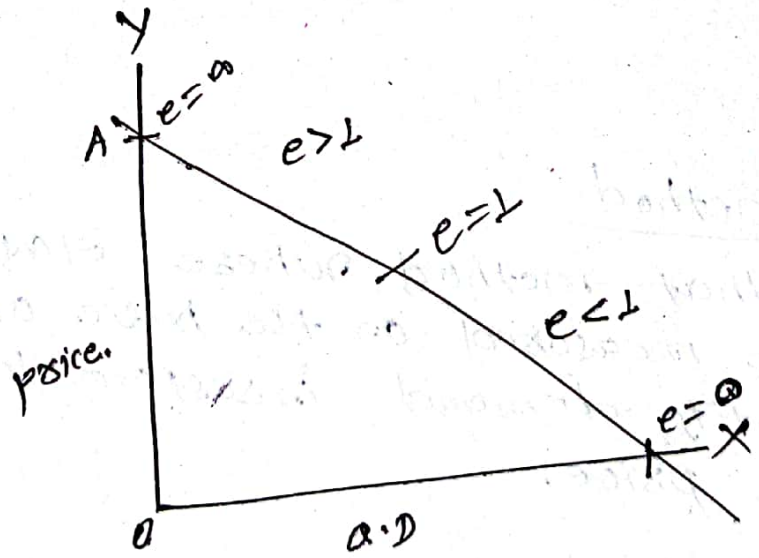
$\frac{\Delta Q}{Q} = 0$

$\Delta Q = 0$

$e = 0$



Q) Show all the degree of elasticity on a straight line downward sloping ~~straight~~ curve or demand curve.



Determination of elasticity of demand or factor affecting elasticity of demand

(1) Availability of substitutes.
(2) Nature of the good
(3) Alternative uses
(4) postponement of consumer ($e=0$)
(5) Time period ($e>1$)
(6) Habit ($e=0$)

Methods of measuring elasticity of demand.

(1) Percentage method
(2) Arc method / mid-point method
(3) Total expenditure / total outlay method.

(1) Percentage method

It refers to that method where elasticity of demand can be measured on the base of percent change in quantity demand in response to percent change in the price.

$$E(e_p) = \frac{\text{Percentage change in Q.D}}{\text{Percentage change in price}}$$

$$E(e_p) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

If price of a commodity increase from ₹35 to ₹48 per unit because of which quantity demand of commodity decrease from 100 to 90 units. find out of elasticity of demand with help of point method.

$Q_1 = 100$ $\quad \Delta Q = 10$ $\quad P_1 = 35$ $\quad \Delta P = -18$

$Q_2 = 90$ $\quad P_2 = 48$

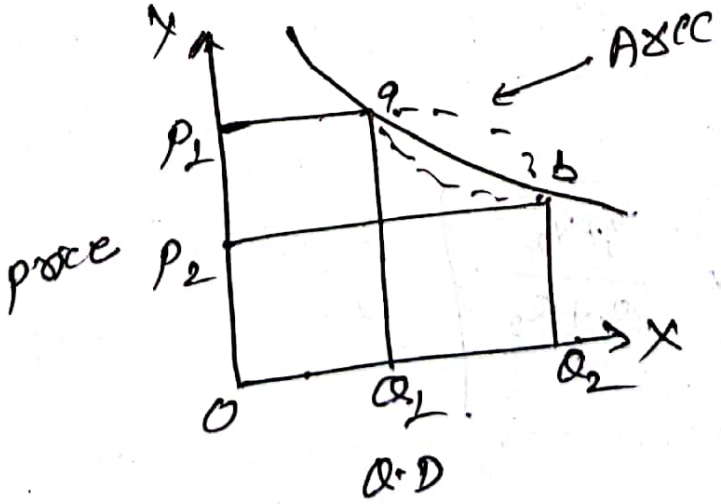
$$E(e_p) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{10}{-18} \times \frac{100}{35}^{20}_{7}$$

$$= 0.26$$

2) ARCC method / mid-point method

It refers to that method where elasticity of demand can be measured between two separate points



$$e_{arc} = \frac{\text{percentage change in quantity demand}}{\text{percentage in price}}$$

$$= \frac{\text{change in Q.D}}{\frac{\text{original Q.D + New Q.D}}{2}} \times 100$$

$$= \frac{\text{change in price}}{\frac{\text{original price + new price}}{2}} \times 100$$

$$= \frac{\frac{\Delta Q}{(Q_1+Q_2)/2} \times 100}{\frac{\Delta P}{(P_1+P_2)/2} \times 100}$$

$$\boxed{e_{arc} = \frac{\Delta Q}{\Delta P} \times \frac{P_1+P_2}{Q_1+Q_2}}$$

Arc income elastic

$$\boxed{e_{arcy} = \frac{\Delta Q}{\Delta Y} \times \frac{Y_1+Y_2}{Q_1+Q_2}}$$

Q) if quantity demand for a commodity decrease from 340 to 310 units due to raise in it's price from Rs 25 to Rs 38 per unit find out elasticity of demand with the help of arc method.

$Q_1 = 340$ $\quad P_1 = 25$

$Q_2 = 310$ $\quad P_2 = 38$

$\Delta Q = -30$ $\quad \Delta P = 13$

$$e_{arc} = \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2}$$

$$= \frac{-30}{13} \times \frac{25+38}{340+310}$$

$$= \left| \frac{-30}{13} \times \frac{63}{650} \right|$$

$$= |0.22|$$

3) Total expenditure / Total outlay method.

It refers to that method where elasticity of demand can be measured on the basis of change in the total expenditure on a commodity due a change in a quantity demand for the commodity in response to a change in a price

$T.E = P \times Q$

P → price of the commodity per unit

Q → No. of units of the commodity purchased

Three possibilities

1) if total expenditure increase with a fall in the price or decrease with a rise in the price then price elasticity will be greater than 1.

2) if total expenditure remains constant with rise or fall in price then price elasticity will be equal to 1.

3) If total expenditure increases with a rise in price or decrease with a fall in the price then price elasticity will be less than 1.

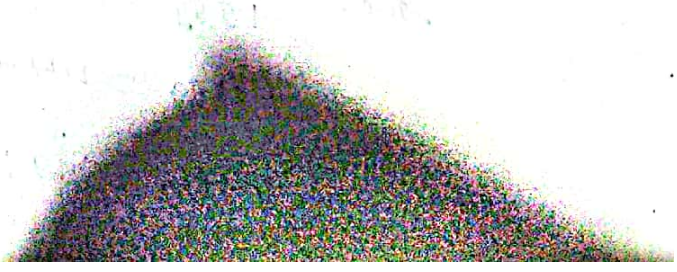
Price	Q.D	T.E	Ep
5.00	30	150	-
4.75	40	190	e>1
4.50	50	225	e>1
4.25	60	255	e>1
4.00	75	300	e>1
3.75	80	300	e=1
3.50	83	290.5	e<1
3.25	87	282.75	e<1

Q if quantity demand for a commodity increases from 8 to 10 units due to a fall in the price from Rs 10 to 8 per unit find out elasticity of demand with the help of total expenditure method.

$Q_1 =$

Q_2

P	Q	T.E	ep
~~10~~	8	80	
18	10	80	e=1



Demand forecasting (odd case)

From the following table forecast sells for the year 1991 and 1993 so

Years	Sales (Y)	X	X^2	XY
1985	90	-2	4	-40
1986	35	-1	1	-35
1987	42	0	0	0
1988	56	1	1	56
1989	67	2	4	268
	$\Sigma Y = 220$	$\Sigma X = 0$	$\Sigma X^2 = 10$	$\Sigma XY = 2115$

$$\Sigma Y = Na + b\Sigma X$$

$$\Sigma XY = a\Sigma X + b\Sigma X^2$$

$220 = 5 \times a + b \times 0 \Rightarrow a = \frac{220}{5} = 5044$

$2449115 = a \times 0 + b \times 10 \Rightarrow b = 11.5$

$Y = a + bX$

$Y = 44 + 11.5X$

1991 - 1987

linear eq? $Y = a + bX$

for $Y_{1991} = 44 + 11.5 \times 4 = 90$

$Y_{1992} = 44 + 11.5 \times 5 = 111.5$

$Y_{1993} = 44 + 11.5 \times 6 = 113$

from the following table. forecast sales for the year 2016 & 2017

2012.5 (Even case)

Years	Sales	X	X^2	XY
2010	10	-2.5	6.25	
2011	18	-1.5	2.25	
2012	22	-0.5	0.25	
2013	35	0.5	0.25	
2014	42	1.5	2.25	
2015	53	2.5	6.25	
	$\Sigma Y = 180$	$\Sigma X = 0$	$\Sigma X^2 = 17.5$	$\Sigma XY = 150$

$\Sigma Y = Na + b\Sigma X$

$180 = 6 \times a + 0$

$a = 30$

$\Sigma XY = a\Sigma X + b\Sigma X^2$

$150 = a \times 0 + b \times 17.5$

$b = 150/17.5 = 8.57$

$Y = a + bX$

$Y_{2016} = 30 + 8.75X$

$= 30 + 8.75 \times 3.5 =$

2016 - 2012.5

= 3.5

X = 2013 - 2012.5

= 0.5

$Y_{2017} = 30 + 8.75 \times$

$30 + 8 \times 4.5$

=

Revenue

It refers to the income earned by a produced by selling different units of output at different prices.

Types of Revenue

i) Total Revenue (TR)
ii) Marginal " (MR)
iii) Average " (AR)

i) Total Revenue (TR)

It refers to total income earned by a produced by selling different units of output at different price.

$$TR = P \times Q$$

P → Selling price
Q → no. of units of output sold.

(II) Marginal Revenue (MR)

It refers to the net addition to the total revenue by selling one extra unit of output

$$MR_n = TR_n - TR_{n-1}$$

$$MR_n = \frac{dTR}{dQ}$$

iii) Average Revenue (TR)

It refers to the total income earn per unit of output sold

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

$$TR = AR \times Q$$

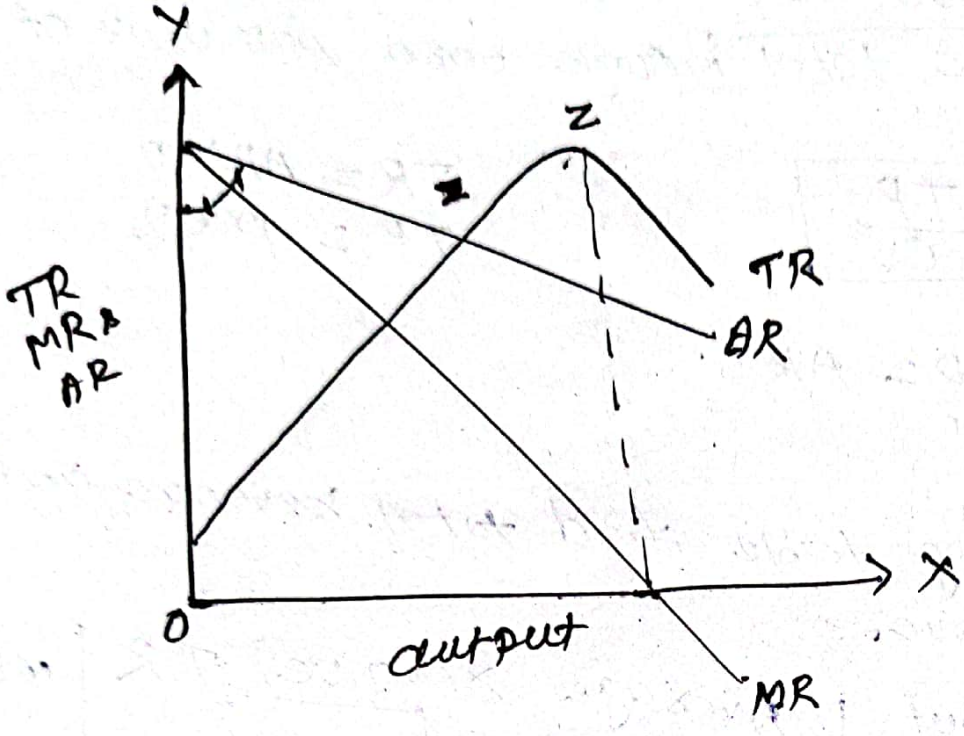
$$TR = P \times Q$$

$$\therefore P = AR$$

From the following table find total revenue and marginal revenue.

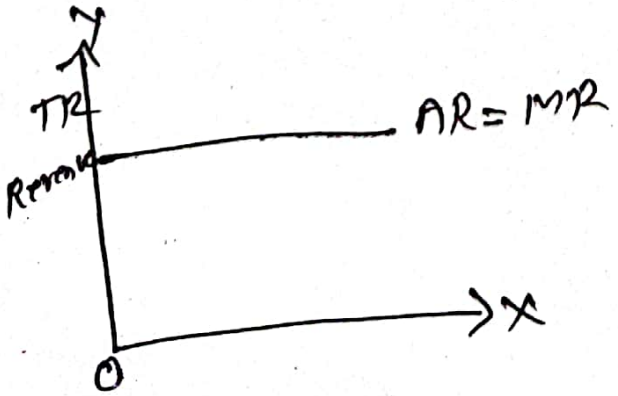
units of output sold (Q)	Average revenue P = AR	TR	MR
1	16	16	16
2	150	30	14
3	140	42	12
4	13	52	10
5	12	60	8
6	11	66	6
7	10	70	4
8	9	72	2
9	8	72	0
10	7	70	-2

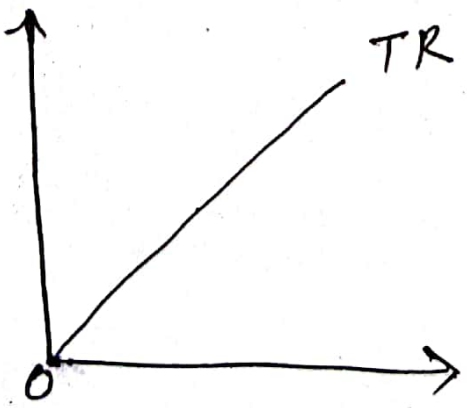
Total revenue is maximum when MR is zero.



From the following table find out T.R and MR

Q	AR	TR	MR
1	30	30	30
2	30	60	30
3	30	90	30
4	30	120	30
5	30	150	30
6	30	180	30
7	30	210	





From the following demand fxn and TR fxn,
- Q.D & price when TR is maximum.
- Q.D & price when MR is zero.

$$Q = 60,000 - 30P$$

$$TR = P \times Q$$
$$TR = 60,000P - 30P^2$$
$$30p = 600$$

Here, $30P = 60000 - Q$

$$\Rightarrow 30P = 60,000 - Q$$
$$P = 2000 - Q/30$$

$$TR = 2000Q - \frac{Q^2}{30}$$

Also,

$$TR = PXQ$$

$$MR = \frac{dTR}{dQ} = 2000 - \frac{Q}{15}$$

for maximum $MR = 0$

$$2000 - \frac{Q}{15} = 0$$

$$Q = 30,000$$

Relationship between revenue and elasticity

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

$$MR = \frac{d(TR)}{dQ}$$

$$= \frac{d(P \times Q)}{dQ}$$

$$= P\frac{dQ}{dQ} + Q\frac{dP}{dQ}$$

$$= P + Q\frac{dP}{dQ}$$

$$= P\left(1 + \frac{dP}{dQ}\frac{Q}{P}\right)$$

$$= P\left(1 + \frac{1}{-e}\right)$$

$$MR = P\left(1-\frac{1}{e}\right)$$

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

we know $P = AR$

Find out MR when price of commodity is Rs 2 per unit and coefficient of elasticity is 3.

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

$$= 2\left(1-\frac{1}{3}\right)$$

$$= \frac{4}{3}$$

Supply

STOCK:- It refers to the total amount of production

Supply:- It refers to the actual amount offer for sell in the market

Supply schedule

It refers to the tabular representation of different quantity of ~~same~~ commodity to the market at difference prices

Price	Q.D.S
5	10
15	17
25	19

Types of supply schedule

i) Individual supply schedule
ii) Market supply schedule

I) Individual supply schedule

It refers to tabular representation of different quanity of a commodity supply to the market at different prices by an individual producer.

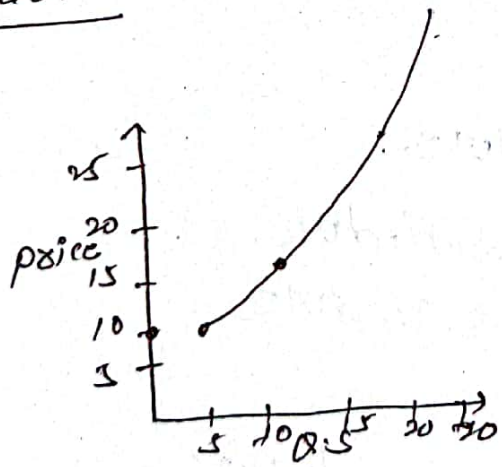
price of x	Q.S of x
100	2
80	3
50	4
25	6

Market Schedule

It refers to tabular representation of different quantity of commodity supply to the market by all the producers at different price

price of X	Consumers			
	Q.S for A	Q.S for B	Q.S for C	Market demand
40	1	2	4	7
30	2	5	8	25
20	3	8	13	25

Supply curve.



Law of supply

It is defined as other factors remains constant quantity supply of accomodity increase with size in price and decrease with fall in price.

Assumption of the Law

(I) Technique of production remain constant
(II) price of input " "
(III) price of other product " "
(IV) No of producers in the market "
(V) motive of the producers " "

- Supply schedule.
- Supply curve
- Limitation of the Law of Supply.

Limitation

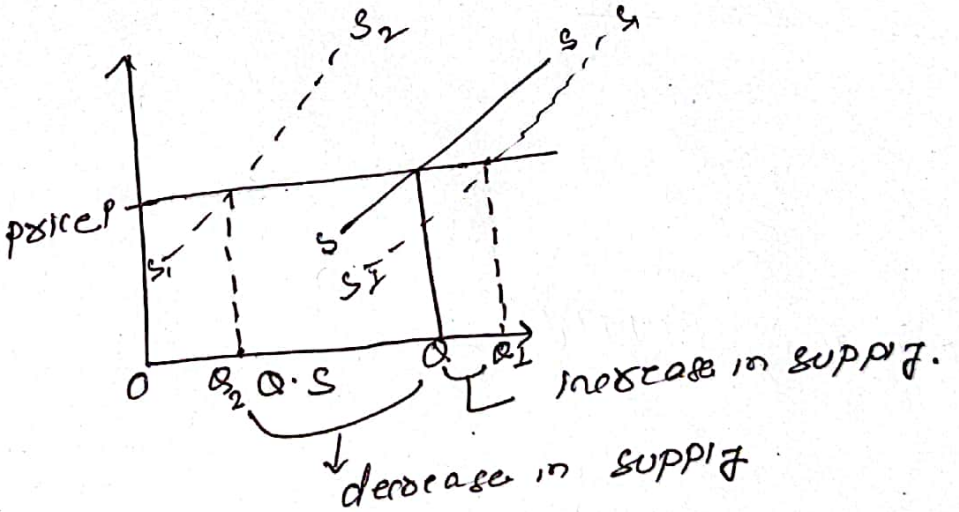
- In case of old coin and case painting
- " " " old stock
- If labour price increase
- A business person at the time of closing his/her business.

Change in Supply.

When supply of a commodity changes due to a change in other factors price remaining constant it is called change in supply.

Types of change in Supply

1) Increase in supply
2) Decrease in supply.



1) Increase in supply

Change in quantity supply

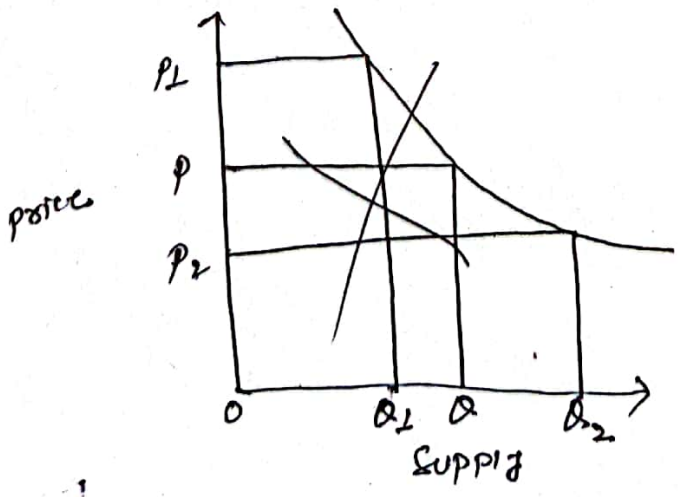
When supply of a commodity changes due to change in it's price other factors remaining constant it is called change in quantity supply.

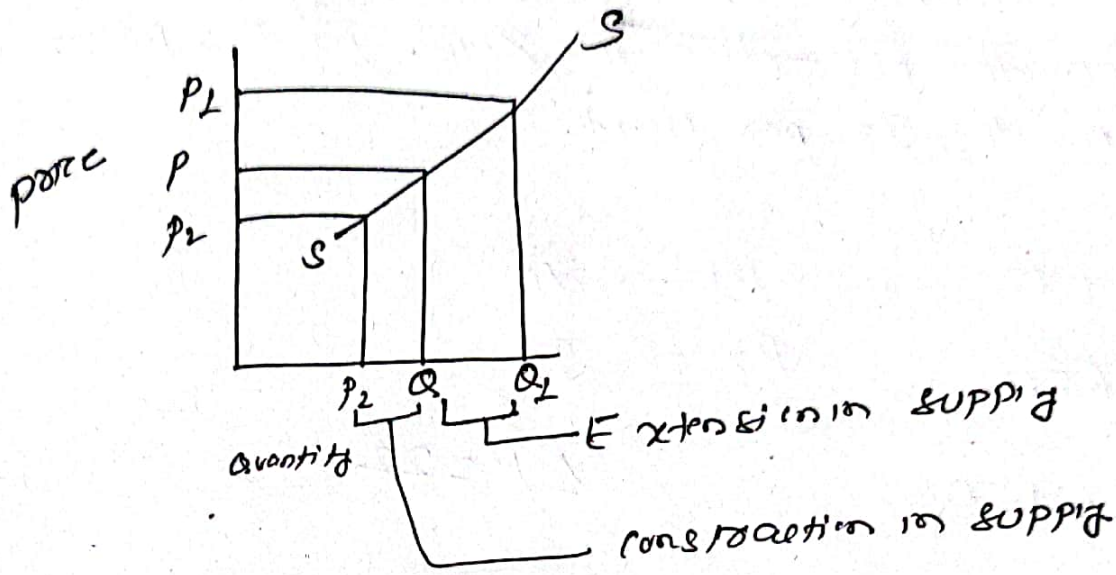
Types of change in quantity supply

i) Extension in supply
ii) Contraction in supply

i) Extension in supply

ii) Contraction in supply





Elasticity of supply

It refers to the degree of quantity supply of a commodity in response to a change in its price

$$e_s = \frac{\text{percentage change in } Q_s}{\text{percentage change in price}}$$

$$e_s = \frac{\Delta Q_s}{\Delta P} \times \frac{P}{Q_s}$$

$$e_s = \frac{dQ_s}{dP} \times \frac{P}{Q_s}$$

if quantity supply of a commodity increases from 500 to 650 due to a raise in the price from Rs 70 to 92 per unit.

Sol:

$Q_{S_1} = 500$ $\quad P_1 = 70$

$Q_{S_2} = 650$ $\quad P_2 = 92$

$\Delta Q_S = 150$ $\quad \Delta P = 22$

$$e_S = \frac{\Delta Q_S}{\Delta P} \times \frac{P}{S}$$

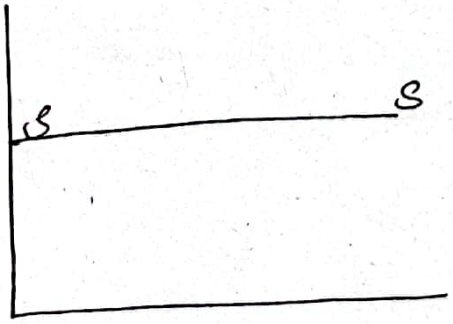
$$= \frac{150}{22} \times \frac{70}{500}$$

$$= 0.954$$

Decrease of elasticity of supply

1. perfectly elastic supply ($e_s = \infty$)
2. Relatively " "
3. unitary " "
4. Relatively inelastic supply
5. Perfectly inelastic supply

perfectly elastic supply



2) Relatively elastic supply. ($E_s > 1$)

Q) From the following demand and supply fn find out equilibrium price and quantity.

$$Q_d = 700 - 20P \quad \text{— (I)}$$

$$Q_s = 300 + 50P \quad \text{— (II)}$$

find out new equilibrium price and quantity if demand remaining constant if supply ~~se~~ increase to $Q_s = 500 + 70P$ — (III)

Solving eqn (I) & (II) ($Q_d = Q_s$)

$$700 - 20P = 300 + 50P$$

$$70P = 400$$

$$P_{eq.} = \frac{400}{70} = 5.71.$$

$Q_d = 700 - 20 \times 5.71$
$= 585.8$

$Q_s = 300 + 50 \times 5.71$
$= 585.5$

Again, Solving eqn, (I) & (III)

$$700 - 20P = 500 + 70P$$

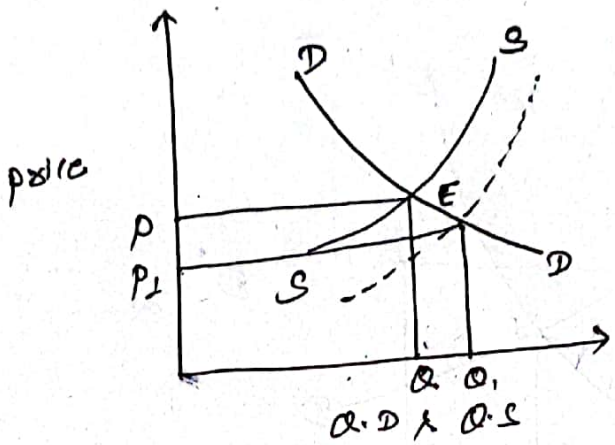
$$90P = 200$$

$$P = \frac{200}{90} = 2.22.$$

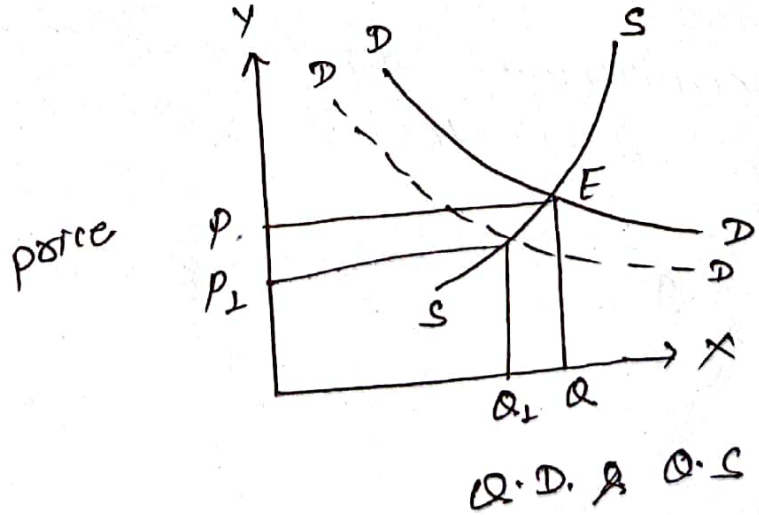
$$Q_s = 500 + 70 \times 2.22$$

$$= 531$$

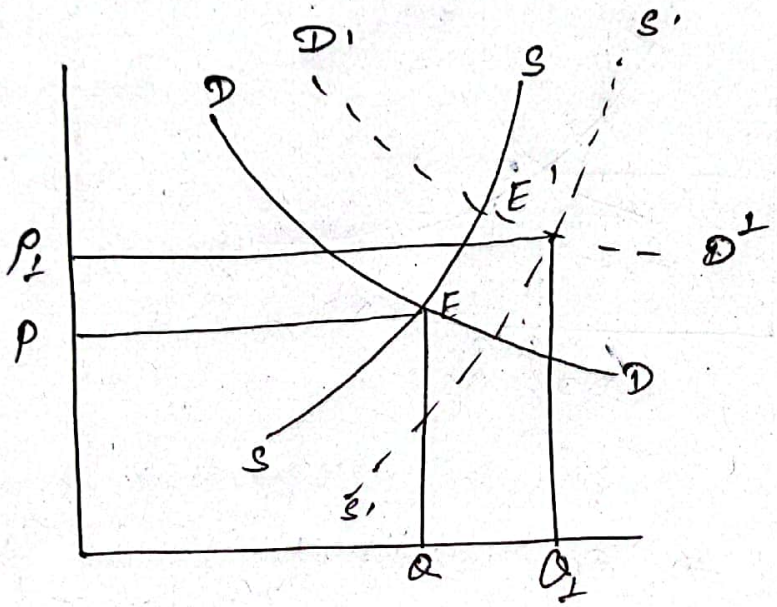
Q) What happend to equilibrium price & Quantity if demand remaining constant and supply increase.



Q) what happend to equilibrium price & quantity if supply remaining constant and demand decrease.



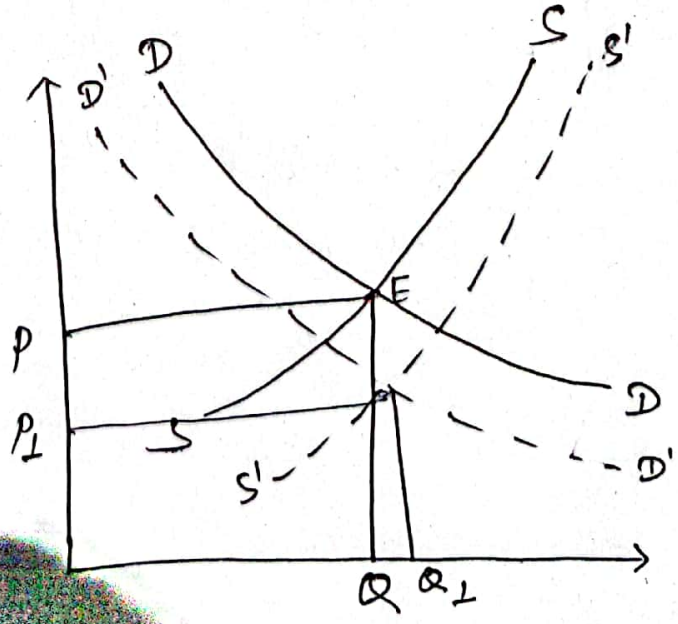
Q) what happens to equilibrium price & quantity if increase in demand is more than increase in supply.



Q.D & Q.S

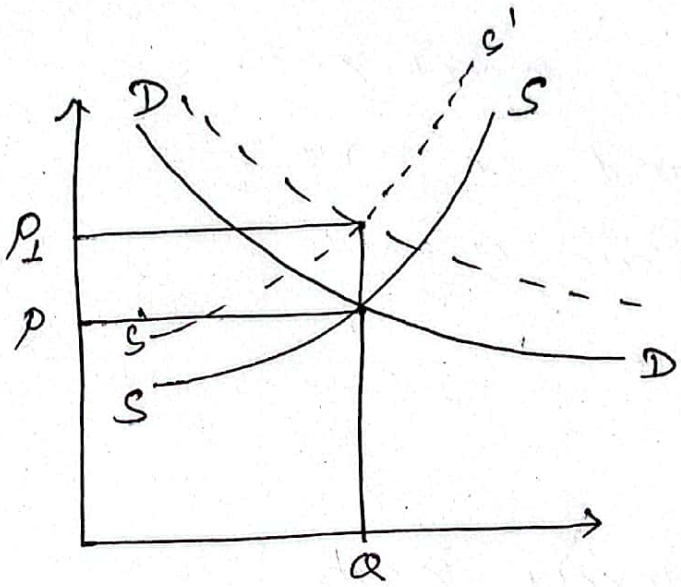
Q) what happens to equilibrium price and quantity if decrease in demand is less than increase in supply.

price ↓
Q ↑



Q.D < Q.S

Q) What happend to equilibrium price & quantity if increase in demand is equal to decrease in supply.



Q.D & Q.S

Interest Rates

Types

1. Simple interest rate
2. Compound " "
3. Nominal " "
4. Effective " "

1) Simple interest rate

It refers to that types of interest rate where principle amount remain same for various years

$I = P \cdot i \cdot N$

- I: Simple interest rate
- P: principle
- i: interest rate
- N: No. of years

(Future interest) $F = P + I$

$= P + P \cdot i \cdot N$

$F = P(1 + iN)$

6) find out future value of ₹ 3,00000 which is deposited in a bank for 3 years at 7%. interest rate, with the help of simple interest rate

$$F = P(1+iN)$$

$$= 500000\left(1+\frac{7}{100}\times 3\right)$$

$$=$$

$$I = P \cdot i \cdot N$$

$$= 500000 \times 7 \times 3$$

(2) Compound interest rate

It refers to that type of interest rate where principle amount keeps on changing every year.

n → no. of years

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

(c) if a person deposit Rs 500000 in a bank at 6.5 % interest rate compound annually find out maturity amount of his account after 10 years

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

$$f_{10} = 500000\left(1 + \frac{6.5}{100}\right)^{10}$$

$$f_{10} = 9,38568.761/-$$

(3) Nominal Interest Rate

It refers to that types of interest rate where interest rate is calculate several times in a year i.e it may be ~~quarterly~~ quarterly, monthly, half, yearly, semi annually and each day to find the compound interest rate.

Quarterly

$$f_4 = P\left(1 + \frac{i}{4}\right)^{4N}$$ (N = no. of years)

half-yearly

$$f_2 = P\left(1 + \frac{i}{2}\right)^{2N}$$

Each day

$$f_{365} = P\left(1 + \frac{i}{365}\right)^{365N}$$

monthly

$$f_{12} = P\left(1 + \frac{i}{12}\right)^{12N}$$

Q) Find out the future value of Rs 10,00000 at 8.5% interest rate if the compounding is monthly after 6 years.

$$f_{12} = P\left(1 + \frac{i}{12}\right)^{12 \times N}$$

$$= 10,00000\left(1 + \frac{8.5/100}{12}\right)^{12 \times 6}$$

$$= 16,62300.08/-$$

Effective Interest Rate

If refers to the ratio of interest charge for one year to the principle amount

$$i_{eff} = \frac{f - P}{P}$$

i_{eff} ↙ effective int. Rate

6) Find out effective interest rate for an amount Rs 7,00000 deposited in a bank at 6% interest rate if the compounding is quarterly.

$$f_4 = 7{,}00000\left(1 + \frac{0.06}{4}\right)^{4\times 1}$$

$$= 742954.485$$

$$\text{Ieff} = \frac{f - p}{p}$$

$$= \frac{742954.485 - 700000}{700000}$$

$$= 6.13\%$$

If principle amount is not given.

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

M: no. of times interest rate is calculate in a year

Q) find out effective interest rate of a credit amount if the interest rate is 15% and the compounding is half yearly.
↳ (two times in a year)

$$i_{eff} = \left(1 + \frac{0.15}{2}\right)^2 - 1$$

$$= 0.1556$$

find out market demand fun^n and elasticity of demand for individual fun^n and market demand fun^n if price of commodity is ₹20 per unit.

$Q_1 = 500 - 10P \quad = 500 - 10 \times 20 = 300$

$Q_2 = 700 - 12P = 700 - 12 \times 20 = 460$

$$Q_m = Q_1 + Q_2$$
$$= 500 - 10P + 700 - 12P$$
$$= 1200 - 22P \quad (20)$$
$$= 760$$

Individual

$$(e_i) = -10 \times \frac{20}{300}$$
$$= 0.667$$

$$(e_i) = -12 \times \frac{20}{460}$$
$$= 0.52$$

Market

$$e_p = \frac{dQ}{dP} \times \frac{P}{Q}$$
$$= -22 \times \frac{20}{760} = 0.57$$

From the following demand fn find out price elasticity of demand & income elasticity of demand if price of the commodity is Rs 20 per unit & income of the consumer is Rs 55,000 per month.

Sol^n

$$Q = 30,000 - 5P + 0.4J$$

$$= 30,000 - 5 \times 20 + 0.4 \times 55,000$$

$$= 51,900$$

$$e_p = -5 \times \frac{20}{51,900}$$

$$= 0.00192.$$

$$e_j = 0.4 \times \frac{20}{51,900} \frac{55,000}{}$$

$$= 0$$

From

Years	Y 1000 Sales(B)	X	X^2	XY
2016	8	-2.5	6.25	-20
2017	18	-1.5	2.25	-27
2018	27	-0.5	0.25	-13.5
2019	32	0.5	0.25	16
2020	49	2.5	2.25	73.5
2021	52	2.5	6.25	130
	186	$\Sigma X = 0$	$\Sigma X^2 = 17.5$	$\Sigma XY = 159$

$\Sigma Y = 186$

22-24 2018.5

$\Sigma Y = Na + b\Sigma X$ (No. of years)

$186 = 6 \times a + 0$

$a = \frac{186}{6} = 31$

$\Sigma XY = a\Sigma X + b\Sigma X^2$

$159 = a \times 0 + b \times 17.5$

$b = \frac{159}{17.5}$

$b = 9.085$

$\Sigma XY =$

$Y = Na + b\Sigma X$

$186 = 6 \times a + b \times 0$

$a = \frac{186}{6} = 31$

$Y_{24} = 31 + 9.085 \times 5.5$

$= 80.9675$

$Y_{22} = Na +$

$Y_{22} = a + bX$

$= 31 + 9.085 \times 3.5 = 62.7975$

$Y_{23} = a + bX$

$= 31 + 9.085 \times 4.5 = 71.8825$

Find out effective interest rate of Rs 7,00000 at 9.5% interest rate if the compounding is monthly

$$f_{12} = 7,00000\left(1+\frac{0095}{12}\right)^{12}$$

$$= \cancel{7055441.6867}$$
$$= 769473.3089$$

$$i_{eff} = \frac{f-p}{p}$$

$$= \left(\frac{769473.3089 - 700000}{700000}\right)$$

$$= 0.09924\%$$

From the following demand fn find out TR and MR fn, - price & quantity for TR to be maximum

$$P = 90,000 - 2Q$$

$Q = 22,500$
$P = 45,000$

$$TR = P \times Q$$

$$TR = 90000Q - 2Q^2$$

$$MR = \frac{dTR}{dQ} = \frac{d(90000Q - 2Q^2)}{dQ}$$

$$= 90000 - 2 \times 2$$

$$=$$

Q For from the following demand fn, find out Q.D if price of the commodity is 25 Rs per unit and income of the consumer is Rs 35,0000 per month

$Q = 30,000 - 20P + 0.5M$

$= 30,000 - 20 \times 25 + 0.5 \times 35,0000$

$= \cancel{46900}\ 47000$

Q find out New Q.D if price remaining const. income increase to 42,000 per month and also find out what type of change in quantity implies and why?

$Q = 30,000 - 20 \times 25 + 0.5 \times 42,000$

$= \cancel{71500}\ 50500$

Q. increase due to increase of income of consumer but price remains constant

Utility

It refers to want satisfying capacity of a commodity

Types of utility

(i) Total utility (TU)
(ii) Marginal utility (MU)

Total utility (TU)

It refers to the total satisfaction that a consumer gets by consuming various units of a commodity.

Marginal utility

It refers to the net addition to the total utility by consuming one extra unit of commodity.

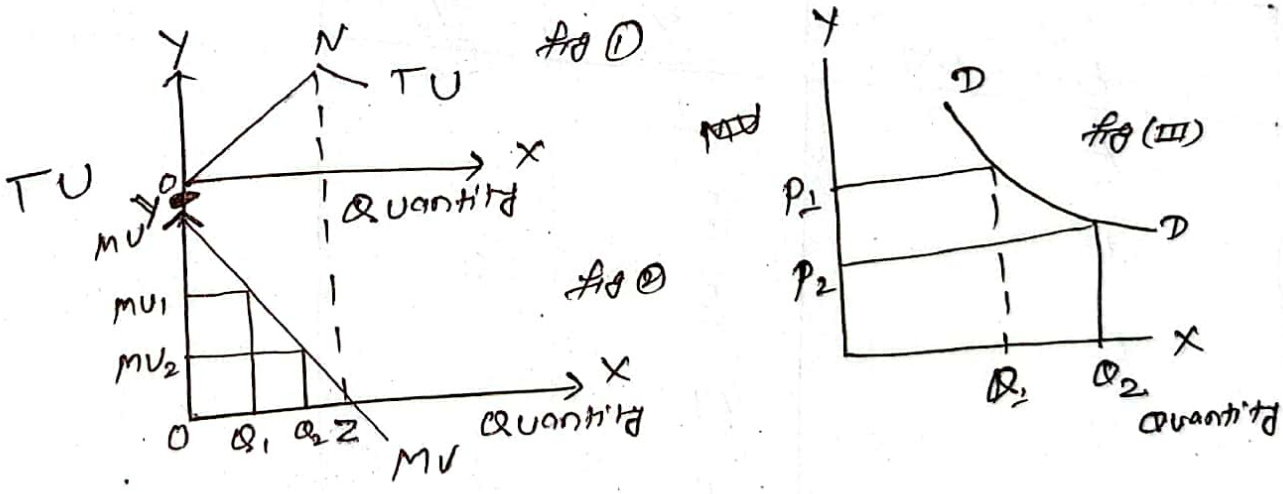
$$MU_n = TU_n - TU_{n-1}$$

$$MU_n = \frac{d(TU)}{dx}$$

Q) From the following table find out marginal utility

Units of the commodity consume	TU	MU
1	10	-
2	18	8
3	24	6
4	28	4
5	30	2
6	30	0
7	26	-4

Total utility curve.



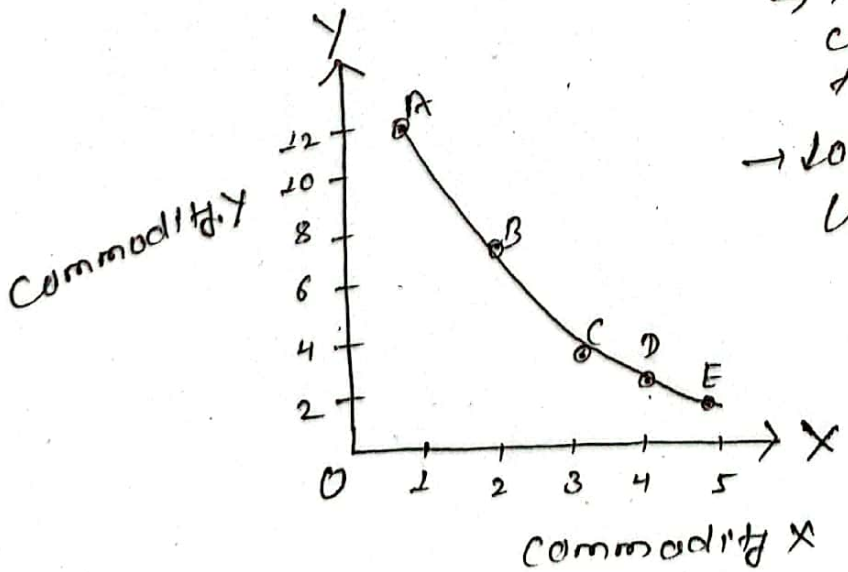
THEORY OF CONSUMER BEHAVIORS

1. Indifference curve
2. Marginal Rate of Substitution (MRS)
3. Budget line.

1. Indifference curve

It refers to those types of curve which show various units of two commodity that equal level of satisfaction to the consumer.

Combination	X	Y
A	1	12
B	2	7
C	3	3
D	4	2
E	5	1



→ Higher indifference curve will be higher the satisfaction.

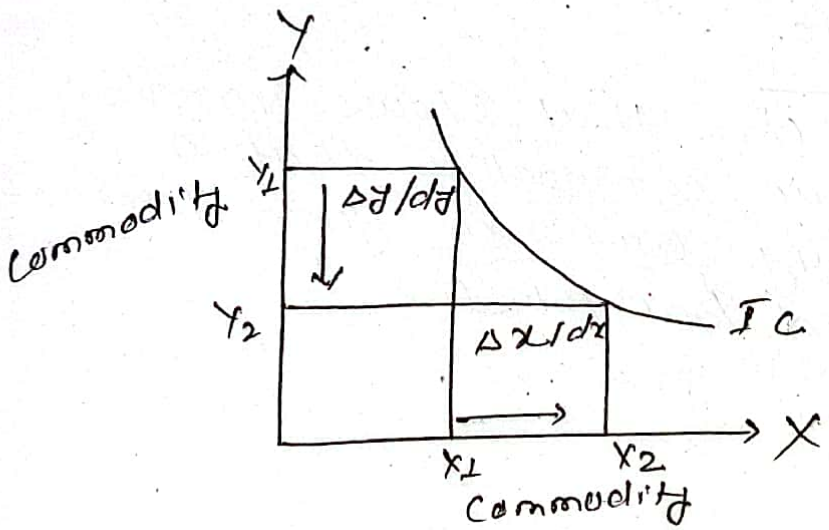
→ Low indifference ↓ low satisfaction

⑤ Marginal rate of substitution (MRS)

It refers to the rate at which no. of units of one commodity substituted to have one more unit another commodity.

MRSxy :- It refers to the rate at which the no. of units of commodity y substituted to have one more units of x

MRSyx :- It refers to the rate at which the no. of units of commodity x substituted to have one more unit of y



Slope of the indifference curve

$$MRS_{xy} = \frac{dy}{dx} = \frac{MU_x}{MU_y}$$

$$MU_x = \frac{dt}{dx}$$

$$MU_y = d$$

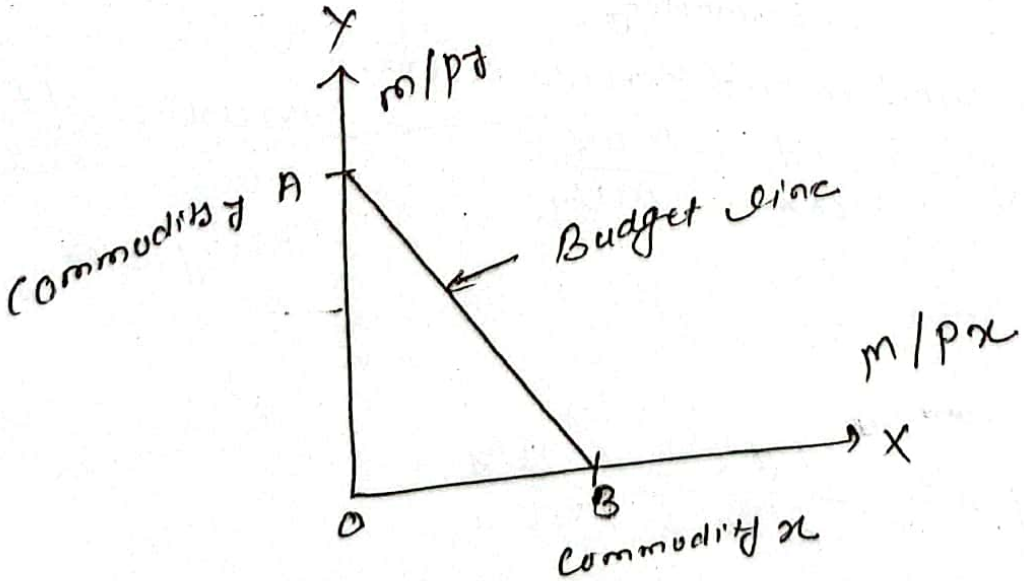
$$MRS_{yx} = \frac{d\,\text{?}x}{dy} = \frac{MU_y}{MU_x}$$

From the following table find out MRS_{xy} & MRS_{yx}

Combination	X	Y	MRS_{xy}	MRS_{yx}
A	1	12	—	—
B	2	7	5/1	1/5
C	3	3	4/1	1/4
D	4	2	1/1	1
E	5	1	1	1

(3) Budget line.

It refers to the line that shows various combination of two commodity that a consumer can buy with a given level of income it is called Budget line



Eqn of budget line

$$M = P_x Q_x + P_y Q_y$$

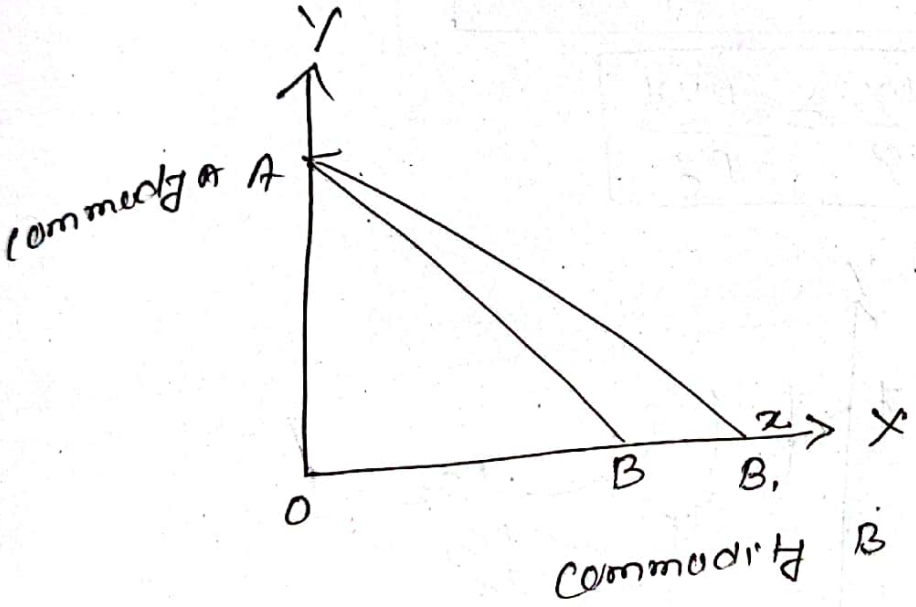
slope $= \frac{OA}{OB}$

$= \frac{m/p_y}{m/p_x} = \frac{p_x}{p_y}$

* Shift in the budget line

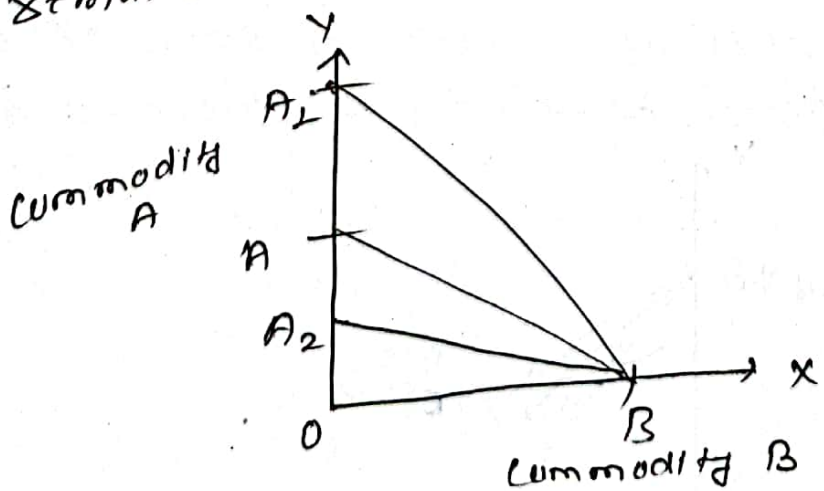
~~When shift in the budget line~~

When consumer purchase more of x, y remaining constant



Shift in the budget line.

if consumer purchase of commodity of y change x remains constant.



Condition for consumer to be in equilibrium

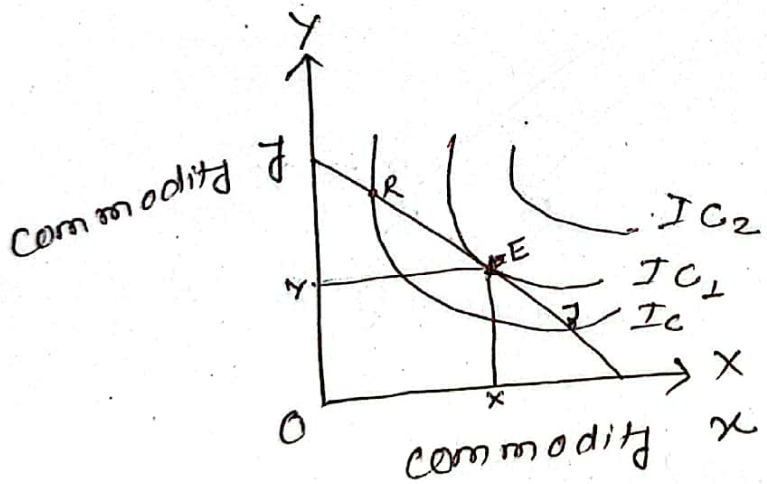
① The slop of the indifference curve is equal to the slop of the budget of the budget line

② The indifference curve should be convex at equilibrium point

Mathematical form of ①,

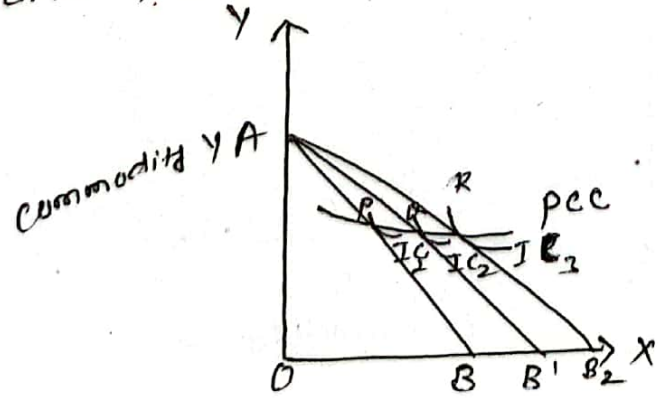
$$MRS_{xy} = \frac{dy}{dx} = \frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

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



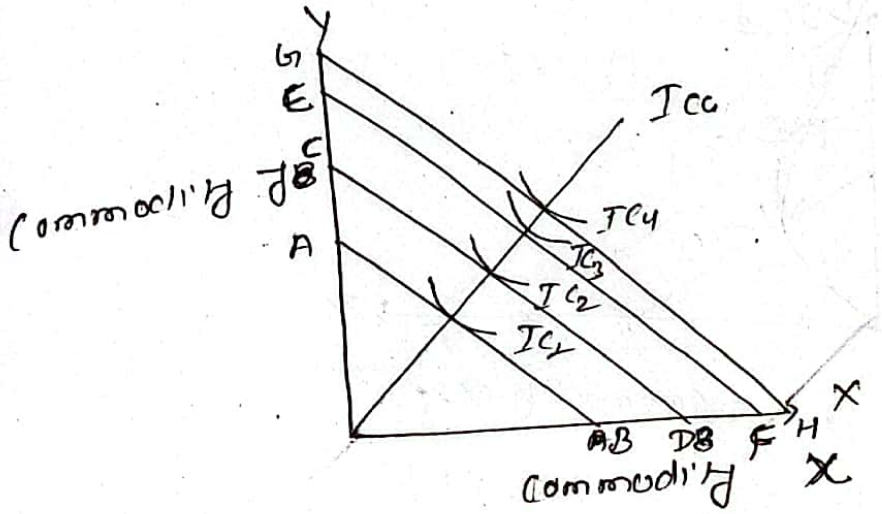
Price Effect

It reflects to the effect of change in price of one commodity on purchase of commodity price of other commodity and ~~price~~ income ~~remain~~ of the consumer remains constant.

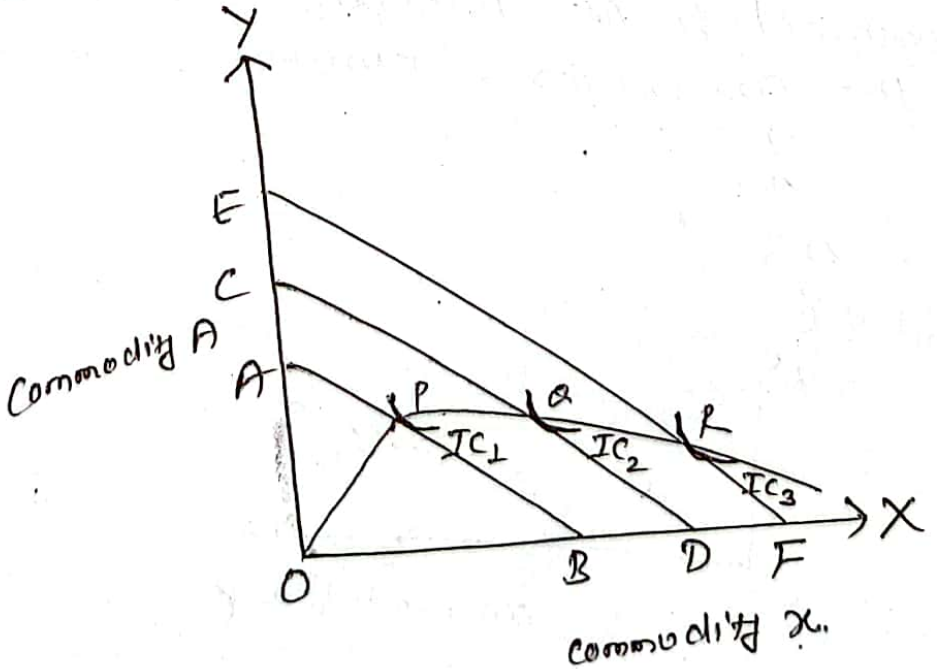


Income effect.

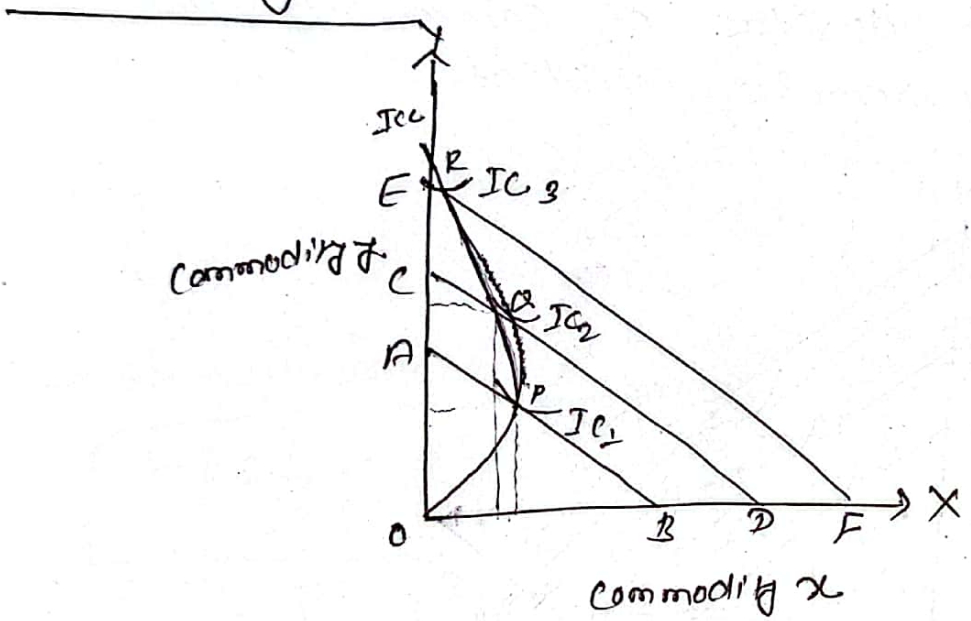
→ It refers to the effect change in the income of the consumer on purchase of commodity price of both commodity remains constant.



Shape of Icc curve if commodity Y is an inferior good

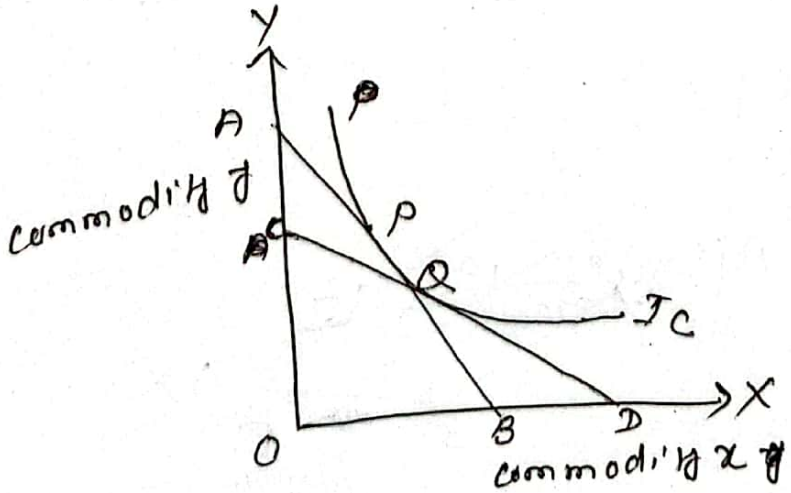


#Shape of the Icc curve if commodity X is inferior good.

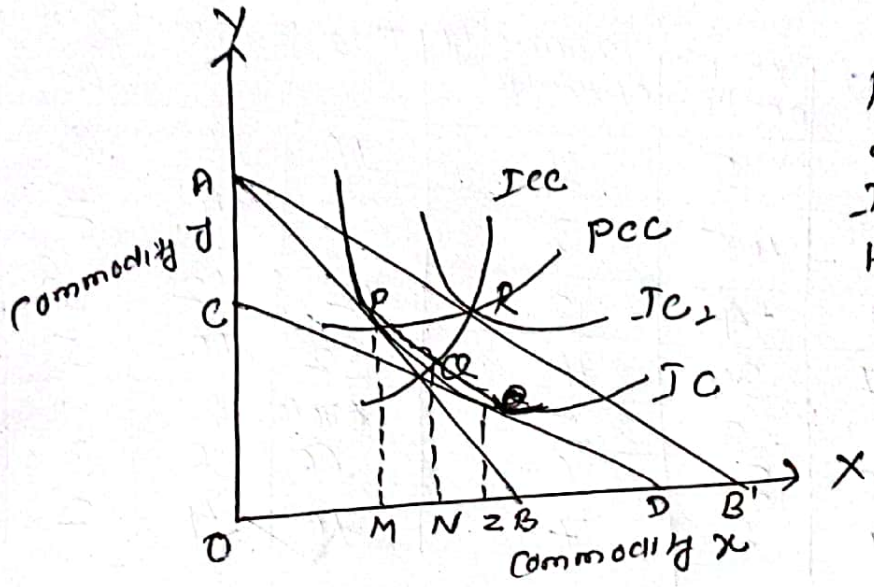


Substitution effect.

It refers to the effect of fall in the price of one commodity and increase in the price of another commodity on purchase of commodity income of the consumer remaining constant.



Relationship among price effect substitution effect and income effect.



PE = MZ
SE = MN
IE = NZ
PE = SE + IE

From the following table

(I) Fill of the table

(II) If income of the consumer is Rs 10. How many unit of commodity X & J purchase by the consumer

(III) If income of the consumer is increase 2 to 10 to Rs 18. find out optimal consumption bundle x & J for the consumer and given factor ax.

price of x x J are Rs 3 x 2 respectively.

Quantity	Commodity X TV	Commodity X MV	Commodity X MU per Rs	TV	Commodity J MV	Commodity J MU (per Rs)
1	45	45	15	40	40	20
2	75	30	10	60	20	10
3	102	27	9	70	12	6
4	120	18	6	82	10	5
5	135	15	5	90	8	4
6	144.99	9.99	3.33	92	2	1

A consumer spends his total income i.e 22 on good a and b whose prices are Rs2 both.

Quantity of good A	TU	MU	MU per Rs
1	10	10	5
2	19	9	4.5
3	27	8	4
4	34	7	3.4
5.	40	6	3
6	45	5	2.5
7	49	4	2

Quantity of good B	TU	MU	MU per Rs
1	16	16	8
2	30	14	7
3	42	12	6
4	52	10	5
5	60	8	4
6.	66	6	3
7.	70	4	2

a) Compare the above table

a) What is the MU per Rs spent on 4th unit of good A?

03) How many unit of good A and B the consumer should have to purchase to maximize utility.

04) Suppose the consumer income increase from Rs 22 to Rs 28, what would be the utility maximizing combination good A and B

(03) $22 = 2 \times (4) + 2 \times (7)$, $22 = 2 \times (5) + 2 \times (6)$

(04) $28 = 2^{A}(7) + 2^{B}(7)$

Time value of Money.

It refers to the value of money at a particular time period.

Cash flow diagram.

It refers to the graphical representation of cash inflow and cash outflow along the timeline

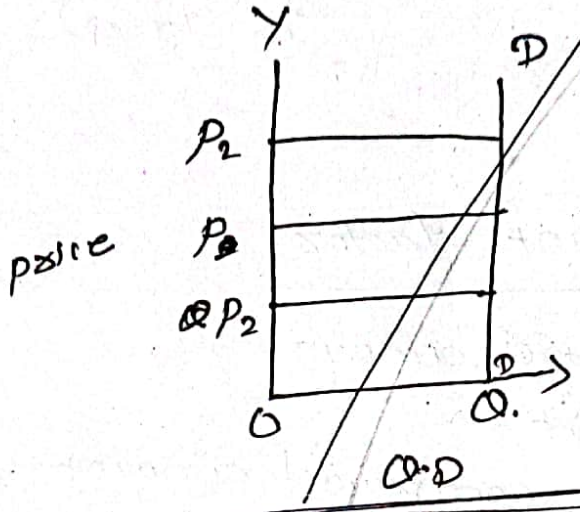
Types of cash flow diagram.

1. Single payment cash flow
2. uniform " "
3. Linear Gradient series
4. Geometric Gradient series
5. Unequal payment series

(1) Single payment cash flow :-

(5) Perfectly inelastic demand

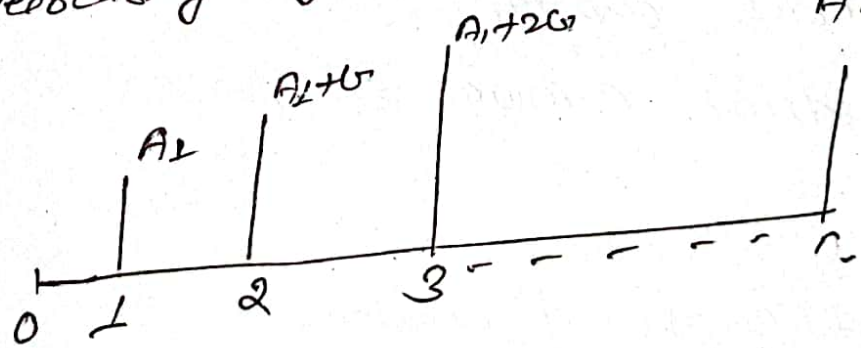
When there is no change in quantity demanded for a commodity in response to change in its price it is called perfectly inelastic demand.



$e = 0$

(3) Linear Gradient Series.

It refers to series of cash inflow or out flow increasing or decreasing by a fix amount

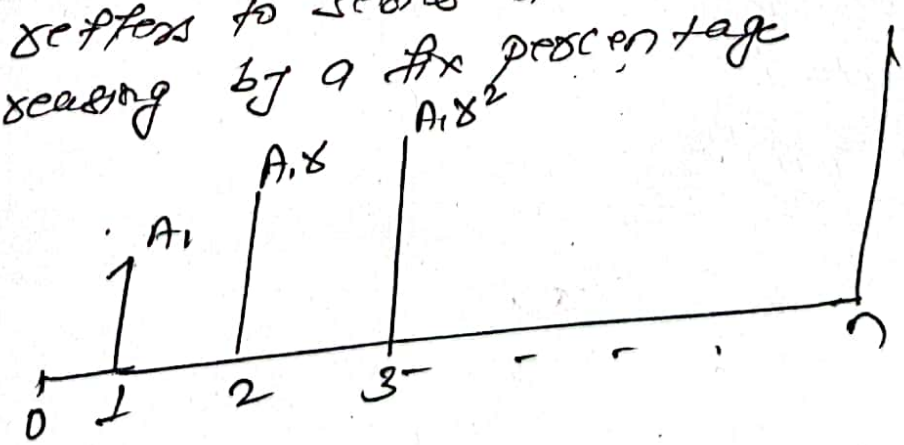


$A_1 = 1000$

$G = 500$

(4) Geometric Gradient Series.

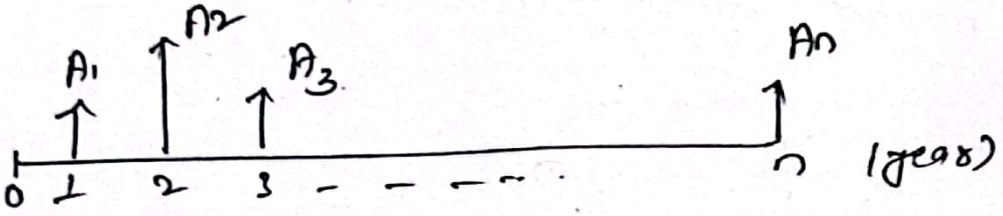
It refers to series of cash flow increasing or decreasing by a fix percentage



(5) Unequal payment series

cashout flow are generally represented by vertical downward arrow where cashinflow are represented by vertically upward.

- Salvage value is also one type of profit.



Types of Compound amount factors.

1. Single payment compound amount
2. Single " present
3. Equal-" " series compound amount
4. Equal " " sinking fund
5. Equal " series present worth Amount
6. Equal " series capital Recovery Amount
7. Linear - Gradient Annual Equivalent Amount

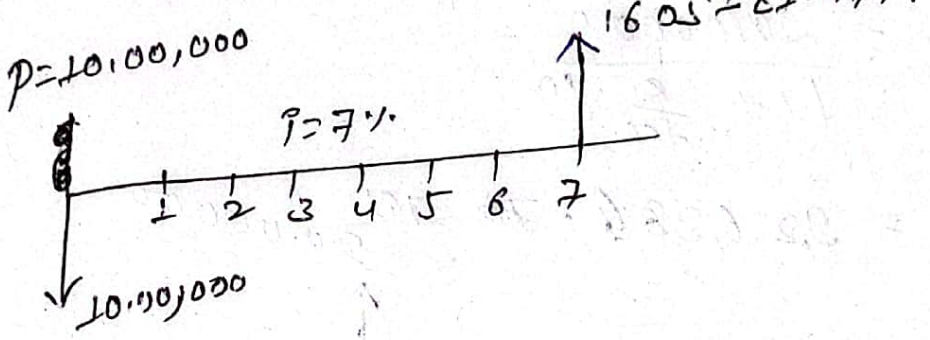
(1) Single payment compound amount

Here the objective is to find the future value of a present sum after nth year compounded at a interest rate i

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

a) if a person deposite ₹10,00,000 now in a bank at 7% interest rate compound rate annually find out the maturity ~~account~~ amount of his amount after 7 years.

$$f = P(1+i)^n$$
$$= 1000000(1+0.7)^7$$
$$= ₹1605781.47/-$$



(2) Single payment present amount

Here the objective is to find the present value of a future sum compound at a interest rate i at n^{th} year.

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

Note:- Any expense or payment made by us will be shown by downward arrow. (outgoing)

- generated revenue, credits, etc are shown by ↑ arrow (incoming money)

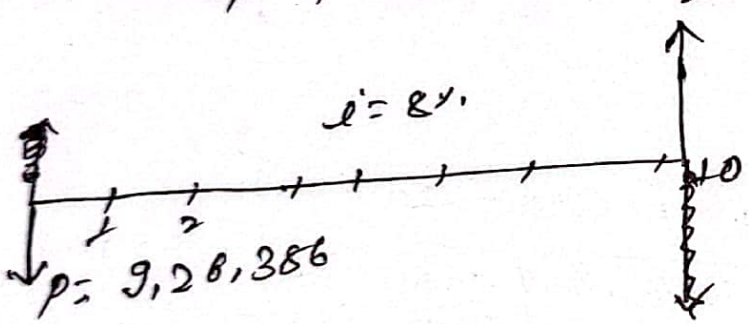
A person needs 20,00000 after 10 years. Find out how much money a person have to deposite now to get 20,00000 after 10 years if the interest rate is 8% compound rate annually.

So:

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

$$= \frac{20,00000}{\left(1+\frac{8}{100}\right)^{10}}$$

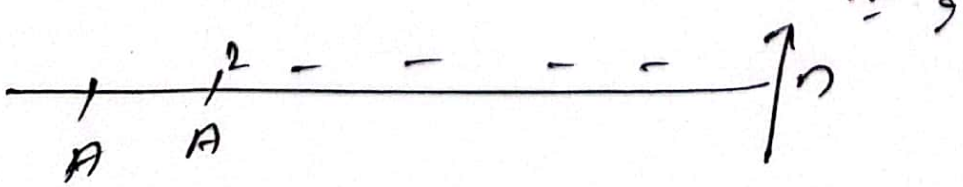
$$= 9,2\,6,386 \cdot 5761$$



(3) Equal payment series compound amount.

Here the objective is to find the future value of n equal payment that is to be made at the end of every year till the end of the nth year compound at interest rate i.

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



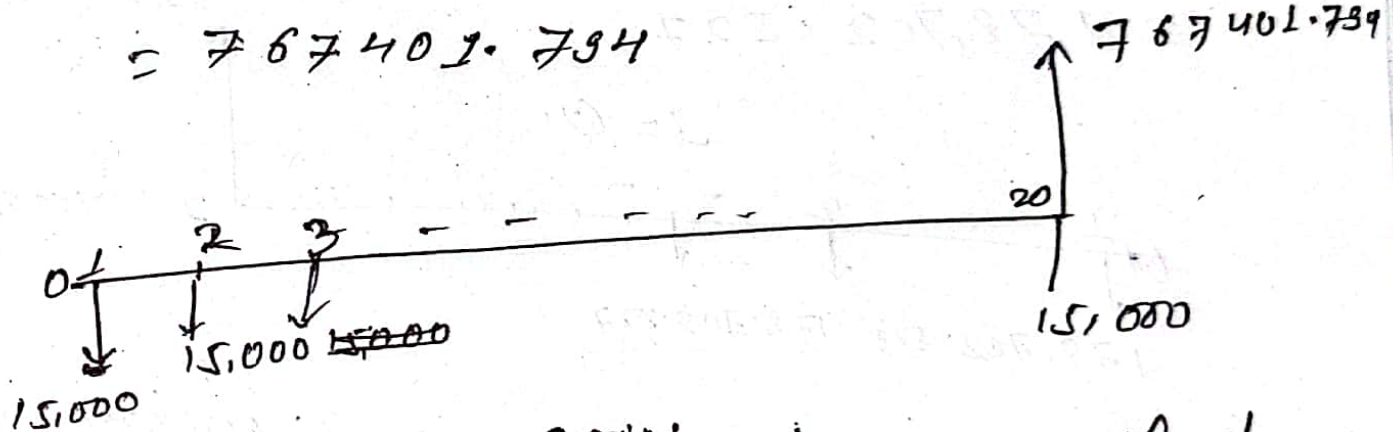
A = Given.

6) if a person deposite ₹ equal amount of ₹15,000 at the end of every year starting from the end of next year find out maturity amount of his account after 20 years. if interest rate is 9% compound at annually.

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

$$= 15,000\left[\frac{(1+0.09)^{20} - 1}{0.09}\right]$$

$$= ₹\,67401.794$$



(4) Equal payment ~~compound~~ sinking fund.

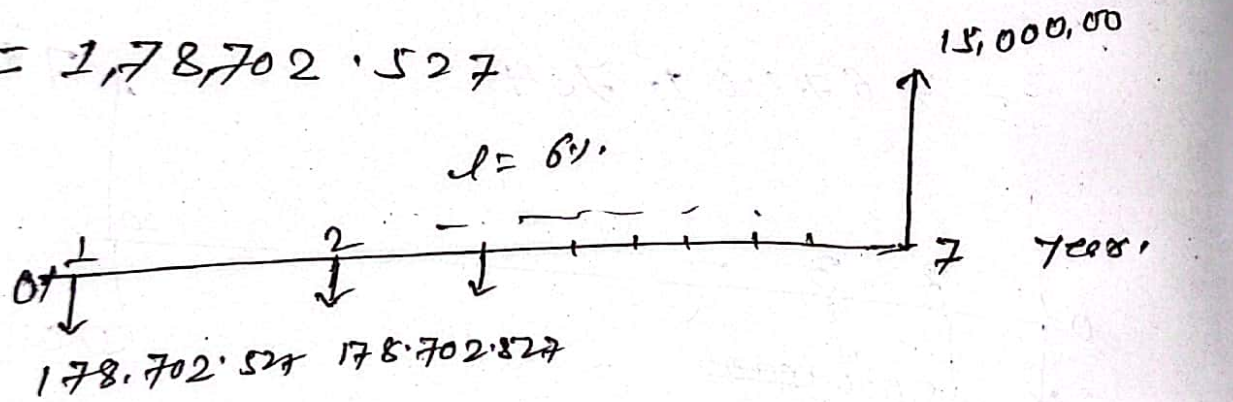
Here the objective is to find n equal payment series that is to be calculated at the end of every years till the end of nth year to realised the future sum after nth year compound at a interest rate i.

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

Q) A persons needs Rs 15,000,00 after seven years find out how equal amount of money the person has to invest every year to get 15,00,000 after 7 years and the interest rate is 6% compound annually.

$$A = 15,00000 \left[\frac{0.06}{(1+0.06)^7 - 1} \right]$$

$$= 1,78,702.527$$



(5) Equal payment series present worth amount

Here, the objective is to find present value of n equal payments that is to be made at the end of every years till the end of nth year compound rate at a interest i.

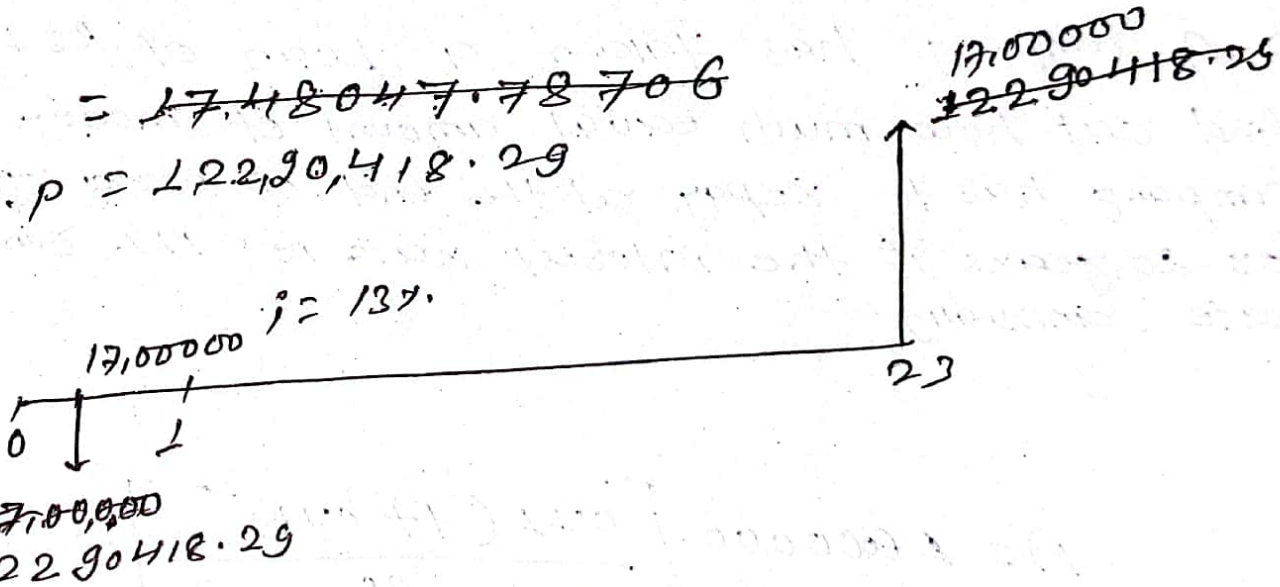
$$P = A \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$$

A company wants to set up a ~~result~~ reserve which will help it to have an annuity equivalent amt of ₦17 billion for the next 23 years towards its corporate welfare ~~matters~~. measure the ~~reserve~~ ~~is~~ to is to grow at the 13%. compound annually. Find the single payment that should be made as the reserve amount now.

$$P = 17,000,00\left[\frac{(1+0.13)^{23}-1}{0.13(1+0.13)^{23}}\right]$$

$$= \text{~~17.1804178706~~}$$

$$\therefore P = ₦22,90,418.29$$



~~17,00,000~~
22904118.29

(6) Equal payment series capital recovery amount

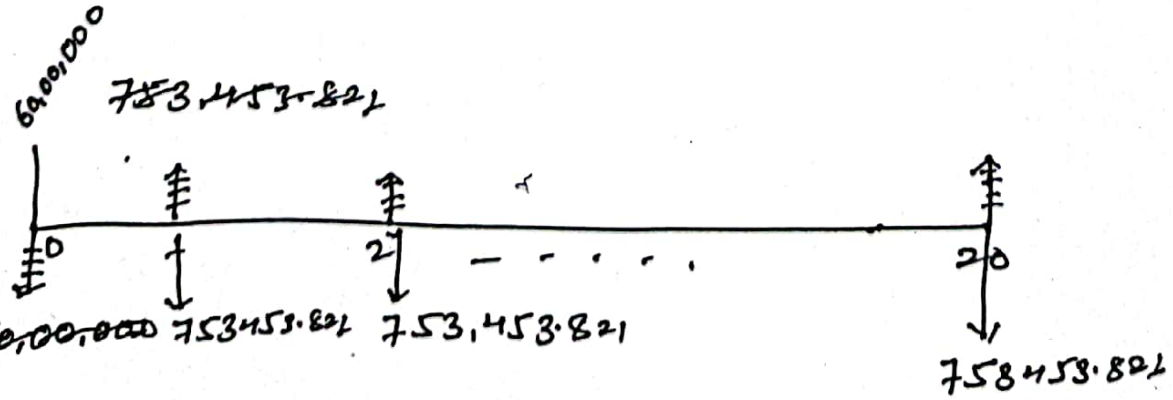
Here the objective is to find n equal payment that is to be recovered at the end of every year till the end of n^{th} year for a loan that is sanctioned now compounded at an interest rate i

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

Q) A company has taken a loan of Rs 16,00000 find out how much equal amount of money the company has to repay at the end of every year for 20 years if the interest rate is 11% compound rate annually

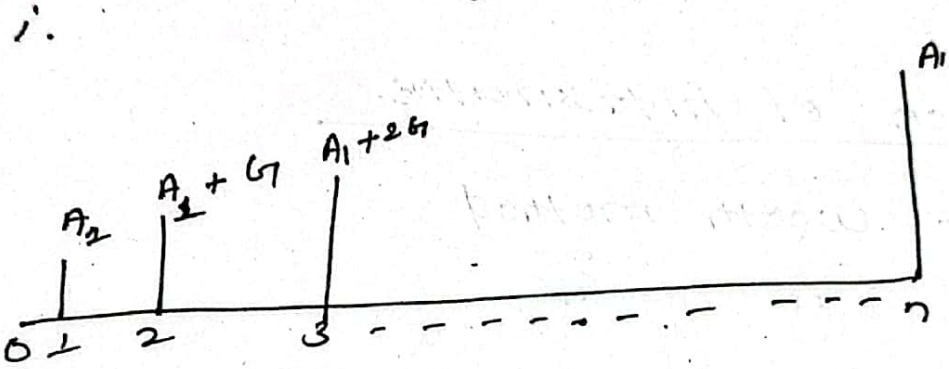
$$A = 6000000\left[\frac{0.11(1+0.11)^{20}}{(1+0.11)^{20}-1}\right]$$

$$= 753,453.821$$



③ Linear Gradient Compound Equivalent Amount

Here the objective is to find annually equivalent amount (A) from a series of equal amount starting in the 1st year (A_1) with a fixed amount either increasing or decreasing. These occurs after following the end of first year compound at a interest rate i.



For Increasing Series.

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

For Decreasing Series.

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

Q) A person is planning for his retired life he has 15 years more services. he would like to deposite 10% of his salary which is Rs5,000 at the end of 1st year with an annually increase of Rs1000 per next 14 years with an interest rate of 10%. compound rate annually find the total amount at the end of 15th year of the above series.

$$A = 5000 + 1000\left[\frac{1}{0.1} - \frac{15}{(1+i)^{15} - 1}\right]$$

$$= 10,278.93$$

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

$$= 10278.93\left[\frac{(1+0.1)^{15} - 1}{0.1}\right]$$

$$= 326,584.922$$

Comparison of Alternatives.

(1) Present worth method
(2) future " "
(3) Annual " "
(4) Rate of Return "
(5) cost benefit Analysis
(6) pay-back period

(1) Present worth method.

In case of one project

$$NPW(i\%) = PW(B) - P(W)(C)$$

If NPW > 0, project will be selected
If NPW < 0, project will be rejected
If NPW = 0, project may or may not selected

In case of more than one project / mutual exclusive project

(i) Revenue based Method
(ii) cost " "

Revenue based Method

It is that method where all types of benefits that profit, revenue and salvage value will be assigned with +ve value and all types of cost i.e payment expenditure or expending will be assigned with -ve sign

cost based method

It is that method where all types of benefits will be assigned with -ve sign and all type of cost will be assigned with +ve sign

Different Sexies.

$$NPW(i\%) = -P + R_1\left[\frac{1}{(1+i)^1}\right] + R_2\left[\frac{1}{(1+i)^2}\right] + \cdots + R_n\left[\frac{1}{(1+i)^n}\right] + S\left[\frac{1}{(1+i)^n}\right]$$

(future value)

Equal payment Res series.

$$NPW(i\%) = -P + R_1\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] + R_2\left[\frac{1}{(1+i)^2} + \cdots + S \rightarrow F\left[\frac{1}{(1+i)^n}\right]\right.$$

Present worth method

Cost Based method Difference series.

$$NPW(i\%) = P + C_1\left[\frac{1}{(i+1)^1}\right] + C_2\left[\frac{1}{(i+1)^2}\right] + \cdots + C_n\left[\frac{1}{(i+1)^n}\right] - S\left[\frac{1}{(1+i)^n}\right]$$

Equal payment series

$$NPW(i\%) = +P + C\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] - S\left[\frac{1}{(1+i)^n}\right]$$

Q) From the following table find out project will be selected or not on the basis of present worth method if I = 12% compounded annually

years	cashflow	∴ -ve sign is just to indicate the cash outflow
0	-80,000	
1	5,000	
2	10,000	
3	25,000	
4	30,000	

Revenue Based method

$$NPW(i\%) = -P + R_1\left[\frac{1}{(i+1)^1}\right] + R_2\left[\frac{1}{(i+1)^2}\right] + \cdots$$

$$R_n\left[\frac{1}{(1+i)^n}\right] + S\left[\frac{1}{(i+1)^n}\right]$$

$$= -80,000 + 4464.28 + 7971.93 + 17794.5061 + 19065.5423 + 0$$

$= -30,703.726$

From the following table find out project is financially feasible or not if $i = 14\%$ compounded annually on the basis of present worth method.

year	cash flow	year	cash flow
0	-90,000	11	50,000
1	50,000	12	50,000
2	50,000	13	50,000
3	50,000	14	50,000
4	50,000	15	50,000
5	50,000	16	50,000
6	50,000	17	50,000
7	50,000	18	50,000
8	50,000	19	50,000
9	50,000	20	50,000
10			

Equal payment series

$$NPW(i\%) = -P + C\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] - S\left[\frac{1}{(1+i)^n}\right]$$

$$NPW(14\%) = -90,000 + 50,000\left[\frac{(1.14)^{20} - 1}{0.14(1.14)^{20}}\right]$$

$$= 2,41,158.527$$

$\therefore$ project is financially feasible since $NPW(14\%) > 0$

From the following table find out which project will be selected on the basis of present worth method if i = 15% compound Annually

project	initial outlay	Annual Income	Life in years
1	10,00,000	5,00,000	15
2	18,00,000	7,00,000	15
3	16,00,000	6,00,000	15

$$NPW(i\%) = -P + C\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] - S\left[\frac{1}{(1+i)^n}\right]$$

project 1

$$NPW(15\%) = -16,00,000 + 5,00000\left[\frac{(1-15)^{15}-1}{0.15(1.15)^{15}}\right]$$

$$= 1923685.04932$$

project-2

$$NPW(15\%) = 22,93,159.06904$$

$$NPW(15\%) = 19,08,422.05818$$

All are feasible but Annuality income of project 2 > project 1, project 3

∴ project 2 will be selected.

From the following table find out which machine will get selected on the basis of present worth method if i 17%. compounded Annually

machine	initial cost	service life	Annual maintenance	salvage value
A	6,00,000	20	35,000	15,000
B	7,00,000	20	40,000	12,000

$$Npw(i\%) = P + C\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] - S\left[\frac{1}{(i+1)^n}\right]$$

Machine A

NPW(i%) = ₹ 96322.663475

Machine B

NPW(i%) 924591.338

A will be selected as cost of A < cost of B.

2) Future worth method.

In case of 1- project

NFW(i%) = fw(13) = ~~Cost~~ fw(c)

If NFW (i%) > 0, project will be selected

If NFW (i%) < 0, " " " rejected

If NFW (i%) = 0, may or may not be selected

In case of mutual inclusive case / more than 1 project.

Revenue based method

Different series

$$NFW(i\%) = -P(1+i)^n + R_1 (1+i)^{n-1} + R_2 (1+i)^{n-2} + \dots + R_n (1+i)^{n-n} + S$$

(P, R, S, F)

Equal payment series.

$$NFW(i\%) = -P(1+i)^n + R\left[\frac{(1+i)^n - 1}{i}\right] + S$$

(P, R, F)

Cost Based method

Different series

$$NFW(i\%) = P(1+i)^n + C_1(1+i)^{n-1} + C_2(1+i)^{n-2} + \dots + C_n - S$$

Equal payment series.

$$NFW(i\%) = P(1+i)^n + C\left[\frac{(1+i)^n - 1}{i}\right] - S$$

(a) From the following table find out which alternative will be selected on the basis of future worth method if $i = 13\%$ compound annually.

particulars	Alternative A	Alternative B
initial cost	4,00,000	6,00,000
uniform annual benefit	64,000	96,000
life in years	15	15

Revenue based method

$$NFW(i\%) = -P(1+i)^n + R_1(1+i)^{n-1}$$

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

for A $$= -400{,}000(1+0.13)^{15} + 64000\left[\frac{(1+0.13)^{15} - 1}{0.13}\right] +$$

$$= 85009.5733$$

for B $= -6,00,000(1+0.13)^{15} + 96,000\left(\frac{(1+0.13)^{15}-1}{0.13}\right)$

$= 127514.36$

'B will be selected

From the following table which machine will be selected on the basis of future worth method if i = 11% compound rate annually.

Particulars	Machine - 1	M-2 ~~Machine~~	M-3
Initial	₹80,00,000	₹70,00,000	₹90,00,000
life in years	17	17 ~~8,00,000~~	17
Annual operation and mentanence cost	8,00,000	9,00,000	850,000
Salvage value	5,00,000	4,00,000	7,00,000

Cost based method.

Machine-1

$NFW(11\%) = P(1+i)^n + C\left[\frac{(1+i)^n-1}{i}\right] - S$

$= ₹80,00,000(1+0.11)^{17} + 8,00,000\left[\frac{(1+0.11)^{17}-1}{0.11}\right] - 5,00,000$

$= 6969642706$

$= 82261415.442$

Machine-2 ₹

$NFW(11\%) = 66780845.68$ 8,09,16417.484

Machine-3

$NFW(11\%) = 90181550.76$

From the following table find out which technology is selected on the basis of future worth method if i = 12% compound annuity.

Particulars	Technology A	Technology B
first cost	15 lakh	20 lakh
annual expenses	70,000 ~~78 lakh~~	90,000 ~~80 lakh~~
tax		
annual income	5 lakh	7 lakh
life in year	15	15

Revenue based method

~~for technology~~ A = 5 lakh − 70,000 = 4,30,000

uniform annual 6,10,000

$$NFW(12\%) = -P(1+i)^n + R\left[\frac{(1+i)^n - 1}{i}\right] + S$$

$$= -15,00,000(1+0.12)^{15} + 4,30,000\left[\frac{(1+0.12)^{15}-1}{0.12}\right] + 0$$

For Technology A

$$NFW(12\%) = 781\,9928.665$$

Technology B

$$NFW(12\%) = 1,17,93,494.42$$

Annual worth Method / Annual Equivalent method.

In case of 01 project.

$$NAW(i\%) = AW(B) - AW(C)$$

If $NAW(i\%) > 0$ project will be selected
If $NAW(i\%) < 0$ project will be rejected
If $NAW(i\%) = 0$ may/ may not be selected.

In case of mutual exclusive project / more than one proj

Equal payment series

Revenue Based method

$$NAW(i\%) = -P\left[\frac{i(i+i)^n}{(1+i)^n - 1}\right] + R + S\left[\frac{i}{(1+i)^n - 1}\right]$$

(P → A, S → F)

cost Based method

$$NAW(i\%) = \left[\frac{i(1+i)^n}{(1+i)^n - 1}\right] + C - S\left[\frac{i}{(1+i)^n - 1}\right]$$

(C → A, S → F)

Different series.

$$NAW(i\%) = NPW\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

(PW → P)

Q. From the following table find out which technology will be selected on the basis of annual equivalent method if i = 18% compound at annually.

particulars	Technology - A	Technolog - B
initial cost end of year 0, 1, 2, 3, 4	5,00,000	7,00,000
	Case inflow year end	(Case inflow year end)
1	10,000 R_1	15,000
2	20,000 R_2	30,000
3	30,000	0
4	45,000 R_3	0
	4 year	Two year

For Technology A

$$NPW(i\%) = -500,000 + 10,000 \overset{R_1}{\left[\frac{1}{(1.18)^4}\right]} + 20,000 \overset{R_2}{\left[\frac{1}{(1.18)^4}\right]} + 30,000\left[\frac{1}{(1.18)^4}\right] + 45\left[\frac{1}{(1.18)^4}\right] + 8^{0}$$

$$= -4,45,842.16811$$

For Technology B

$$NAW(i\%) = -445,842.16811\left[\frac{0.18(1.18)^4}{(1.18)^4 - 1}\right]$$

$$= -165736.7125$$

Technology B

year = LCM = 2 year

$$NPW(i\%) = -6,16,768.70066$$

$$NAW(i\%) = -67768.70066\left[\frac{0.18(1.18)^2}{(1.18)^2 - 1}\right]$$

$$= -426458.7156$$

Benefit of Technology A is more than B so A is selected.

Q) From the following table which machine will be selected on the basis of annual equivalent method i=20% (compound annually.

Machine	Down payment	Yearly equal installment	No of installment
1	5,00,000	2,00,000	150 for each of
2	4,00,000	3,00,000	150
3	6,00,000	1,50,000	15

Cost Based method

$$NAW(i\%) = P\left[\frac{i(1+i)^n}{(1+i)^n-1}\right] + C - S\left[\frac{1}{(1+i)^n-1}\right]^0$$

Machine -1

$$NAW(20\%) = 5,00,000\left[\frac{0.2(1.15)^{15}}{(1.2)^{15}-1}\right] + 2,00,000$$

$$= 3,06,941.059919$$

Machine -2

$$NAW(20\%) = 3,85,552.8479$$

Machine -3

$$NAW(20\%) = 2,78,329.071903$$

The cost of Machine 3 is less so Machine - 3 is selected.

From the following table find out which project will be selected on the basis of annual worth method if i = 25%. Compound annually No. of year (n) = 5 year.

particular	A	B
Investment	1,50,000	1,75,000
Annual equal return	60,000	70,000
Salvage value	15,000	35,000

n=5 i=25%

Project - A

$$NAW(i\%) = P\left[\frac{i(1+i)^n}{(1+i)^n-1}\right] + R + S\left[\frac{1}{(1+i)^n-1}\right]$$

$$= -1,50,000\left[\frac{0.25(1.25)^5}{(1.25)^5-1}\right] + 60,000 + 15,000\left[\frac{1}{(1.25)^5-1}\right]$$

$$= 6050.6901$$

Project - B i=25 n=5

NAW (i%) = 9191.45644

Revenue of 'B' is more so project B will be selected.