MODULE 1

Utility :

Utility is the want satisfying capacity of a commodity.
Utility is ethically neutral.

There are 2 types on the basic of numbers / utils
Cardinal Utility
Ordinal Utility

Cardinal Utility	Ordinal Utility
→ cardinal utility is the utility wherein the satisfaction derivered by the consumption of good can be expressed numerically.	→ Ordinal utility states that the satisfaction derivered ~~fr~~ by the consumption of good cannot be expressed numerically.
→ It is quantitative	→ It is qualitative
→ Measurement unit is utils	→ Measurement unit rank
→ Marginal utility analysis	→ Indifference curve analysis

Total Utility : Total utility is the sum total of utils received by consuming a set of commodities.

Marginal Utility : Change in total utility as a result of consumption of additional unit of a commodity is called marginal utility.

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

here MU = marginal Utility
TU = total Utility
ΔQ = additional unit

Demand Theory :

Demand
Desire + willingness + Ability

Defination : Desire backed by willingness and ability to pay for a commodity.

Demand → available at different price
+
Quantity demand → specific case of demand
i.e particular price what we get

Factors determining demand
- ✓ Price of the commodity
- ✓ Income of the consumer
- ✓ Tastes and preferences
- ✓ Price of related goods (substitute & complements)

Any changes in terms of above mentioned factors will change the demand for the commodity.

Demand Function :

Factors determining demand

Demand f^n ( )

$$D_x = f(P_x, Y, P_R, T, A)$$

where P_x = Price of commodity
Y = Income of consumer
P_R = Retail Price
T = complementary
A = Advertisement

changes other than price are shift factor

Law of Demand :

It states relationships between price and quantity demanded when other things remain constant

- ✓ Inverse relationship
- ✓ If price increases, quantity demanded decreases and vice-versa.

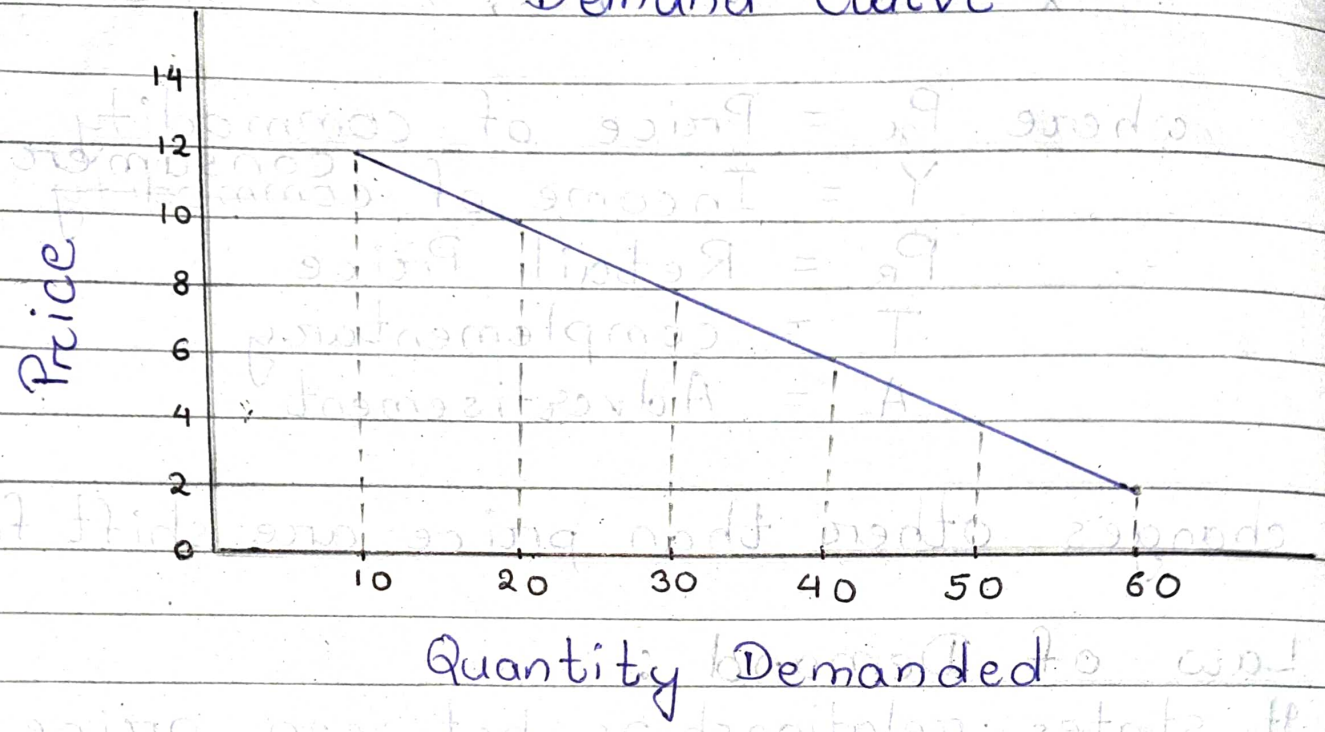
Demand Schedule and Demand Curve

Demand schedule is tabular representation whereas demand curve is the graphical representation of price and quantity demanded relationships.

Demand Schedule for a consumer

Price (INR)	Quantity Demand
12	10
10	20
8	30
6	40
4	50
2	60

Demand Curve



here demand curve slopes downward having two effects :-

1) Income effect
2) Substitution effect

Income effect means when gradually price increases so the amount decreases.
Hence, they become inversely properctional.

NOTE : The inverse relationship between price and quantity demanded is not universally applicable, some exceptional cases are there

Exceptions to the law of demand

- Goods with prestige values : Veblen Effect
  - ✓ doctrine of conspicuous consumption
  - ✓ Some consumers measure the utility of a commodity by its price

Example :

Diamond, BMW cars, etc

- **Giffen Goods**

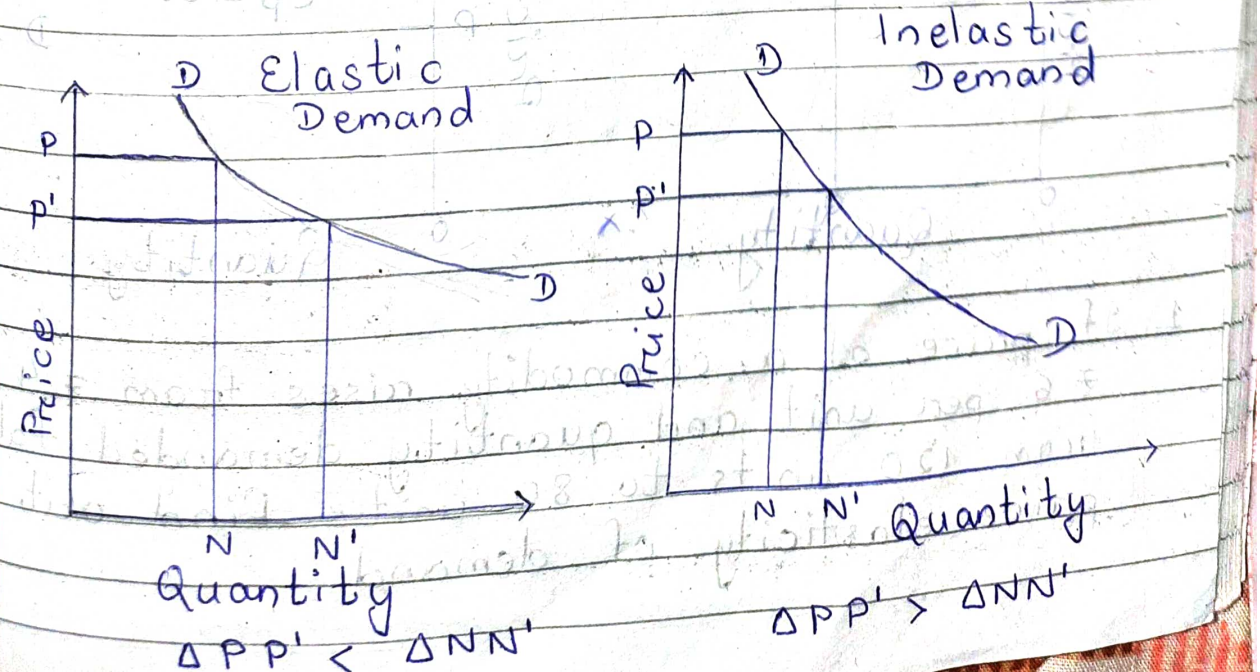
Sir Robert Giffen on British low paid workers.
With the rise in price of Giffen goods, its quantity demanded increases and with fall in its price its quantity demanded decreases.
i.e here demand curve is +ve

Elasticity of Demand

- Price elasticity of demand is a measure of how much the quantity demanded of a good responds to the change in the price of that good.

Price elasticity is the percentage change in quantity demanded to a given percent change in the price.

$$e_p = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$



Measurement

$$e_p = \frac{\%\text{ change in quantity demand}}{\%\text{ change in price}}$$

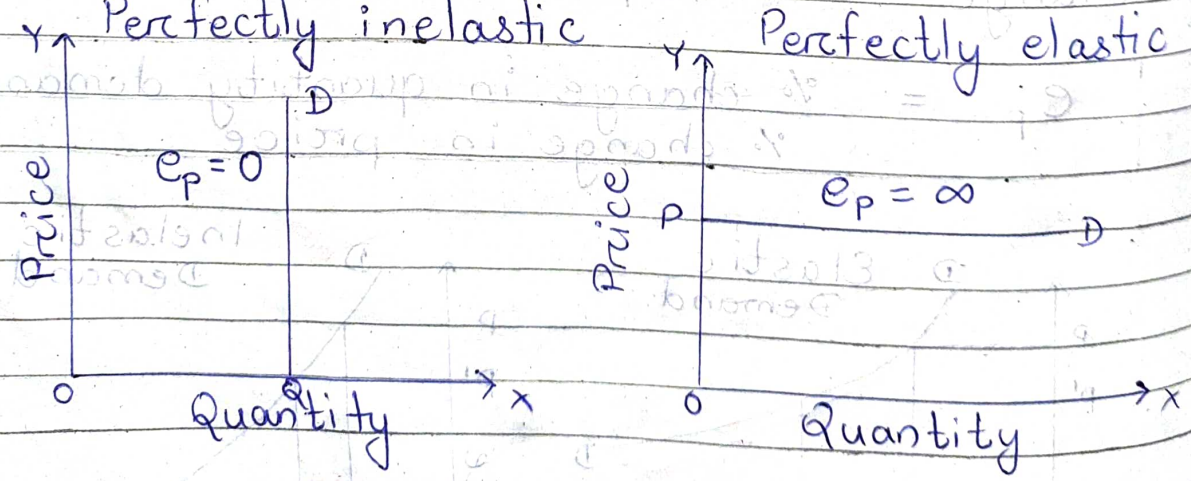
$$e_p = \frac{\text{chang in quantity / Quantity demand}}{\text{change in price / Price}}$$

$$\boxed{e_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}}$$

Price elasticity lies between zero to infinity

$$0 < e_p < \infty$$

$e_p > 1$ elastic Demand
$e_p < 1$ Inelastic Demand
$e_p = 1$ Unitary Eleastic demand



1. If price of a commodity rises from ₹ 4 to ₹ 6 per unit and quantity demanded falls from 120 units to 80 units. Find out price elasticity of demand.

Given :- $P_1 = 4$, $P_2 = 6$, $Q_1 = 120$, $Q_2 = 80$

$\Delta P = 6 - 4 = 2$

$\Delta Q = 40$

$$e_p = \frac{40}{2} \times \frac{4}{120} = \frac{2}{3}$$

Price elasticity from demand function

$$Q = a - bP$$

Slope of demand function is 'b' which is ratio of change in quantity to change in price. It can be written as $\frac{\Delta Q}{\Delta P}$, so $e_p = b \times \frac{P}{Q}$

1. Demand function of milk $Q = 720 - 25P$ Price elasticity at price ₹ 15 per ltr here $b = 25$, Find out price elasticity

Solution :

$b = 25$

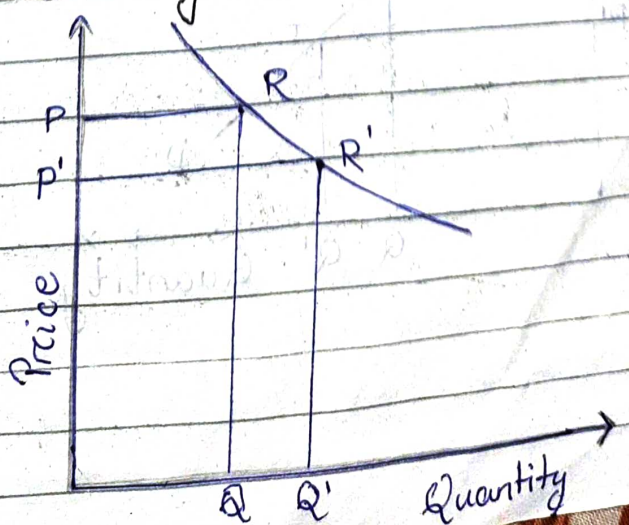
Quantity demanded at ₹ 15

$Q = a - bP$

$Q = 720 - 25(15)$

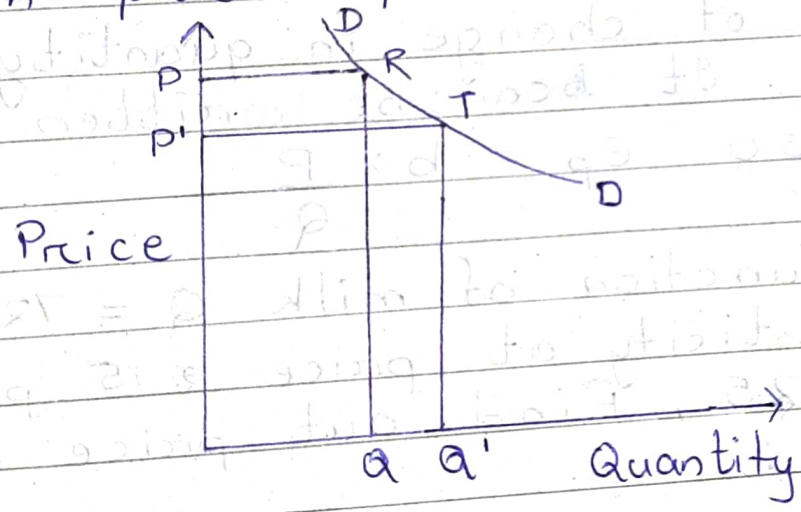
$Q = 345$

Price Elasticity and Total Expenditure

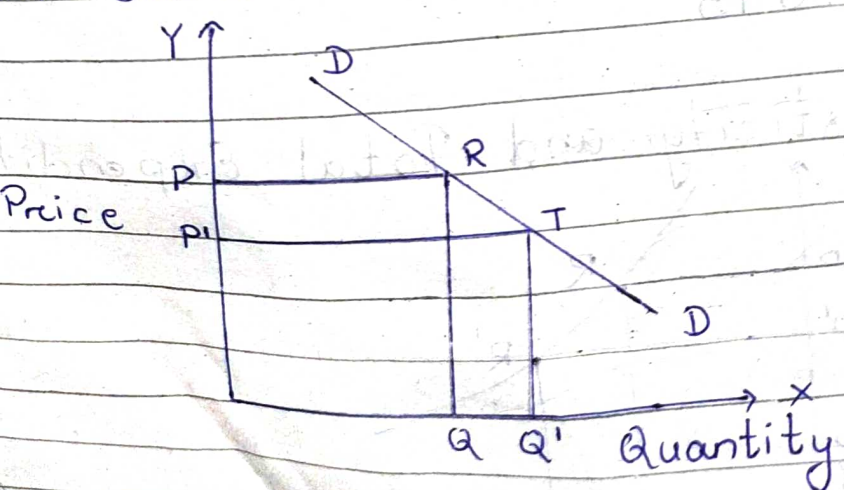


Price Change	$E_p > 1$	$E_p < 1$	$E_p = 1$
Fall	Total expenditure Increases	Total Expenditure Decreases	Total expenditure remain same
Rise	Total expenditure Decreases	Total expenditure Increases	Total expenditure remain same

When total expenditure increases with the fall in price $E_p > 1$

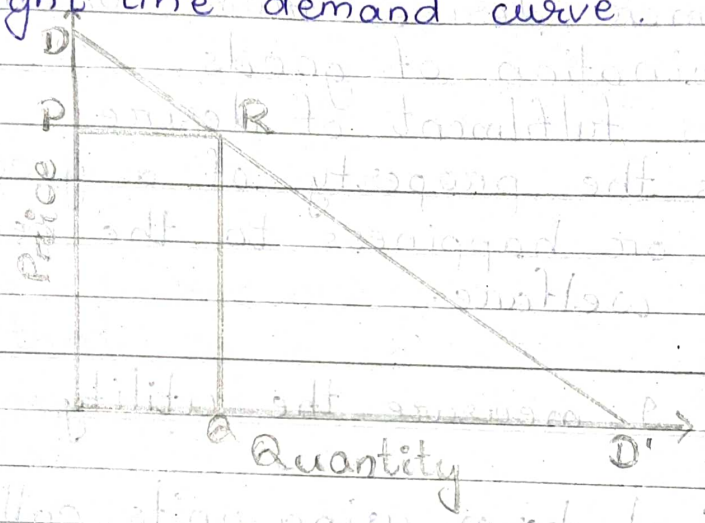


Price elasticity is =1, i.e $e_p = 1$ when, the fall in price of a commodity total expenditure remain same.

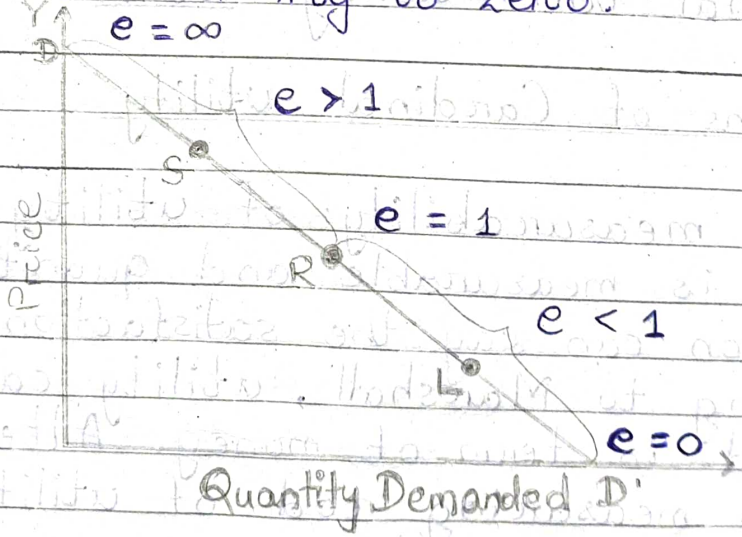


Measurement of price elasticity of demand at a point in a demand curve

Measuring price elasticity at a point on a straight line demand curve.



On a linear demand curve ▼ Price elasticity varies from infinity to zero.



Determinants of Price Elasticity of demand

- Availability of substitutes
- Proportion of consumer's Income spent
- Number of uses of a commodity
- Complementarity between goods
- Time and elasticity

Utility Analysis

Concept of utility

↳ Utility is defined as satisfaction that a consumer derives from consuming a good or combination of goods.
↳ Utility is fulfilment of desire
↳ Utility is the property of a good that provide pleasure or happiness to the people and promotes welfare.

How can I measure the utility

- In cardinal term using units called "utils"
- In ordinal term using "rank"

Assumptions of Cardinal utility

↳ Cardinal measurability of utility
  - Utility is measurable and quantifiable
  - A person can say the satisfaction numbers
  - According to Marshall, utility can be measured in term of money. Alternatively, money is measuring rod of utility.

↳ Hypothesis of Independent utility
  - Utility is additive in nature
  - Utility derived from each commodity is independent to each other.

↳ Constancy of marginal utility of money
↳ Introspective method

↳ On the basis of assumptions, cardinal utility analysis having two important laws which have several applications.

- Law of diminishing marginal utility
- Law of equi-marginal utility

Law of diminishing marginal utility

The law of diminishing marginal utility states that as a consumer goes on consuming more and more units of a particular commodity the utility from successive units diminishes.

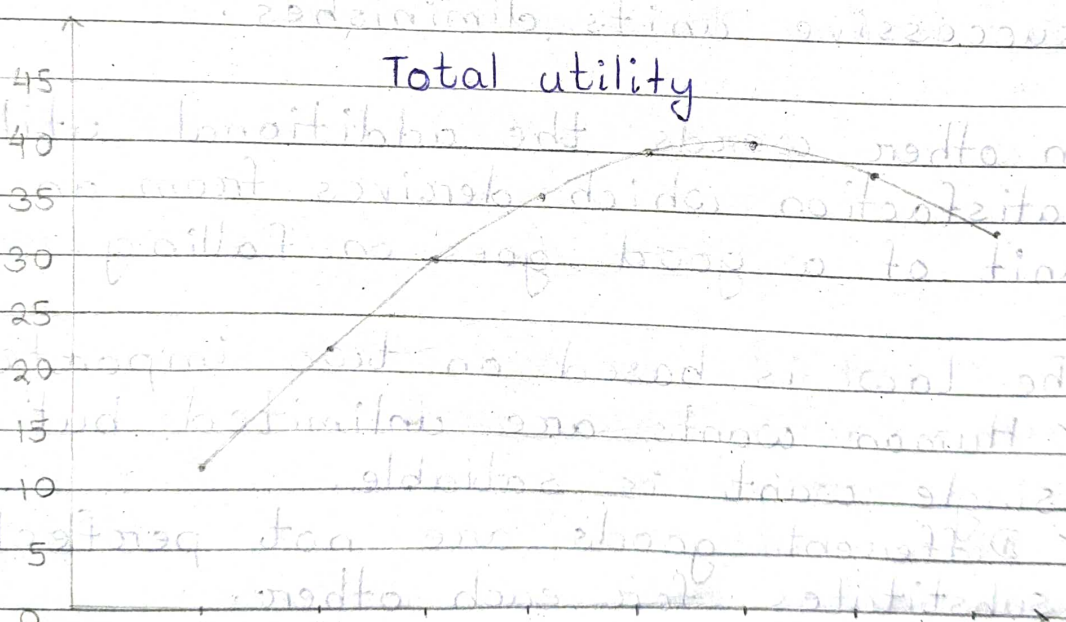
In other words the additional utility or satisfaction which derives from an extra unit of a good goes on falling.

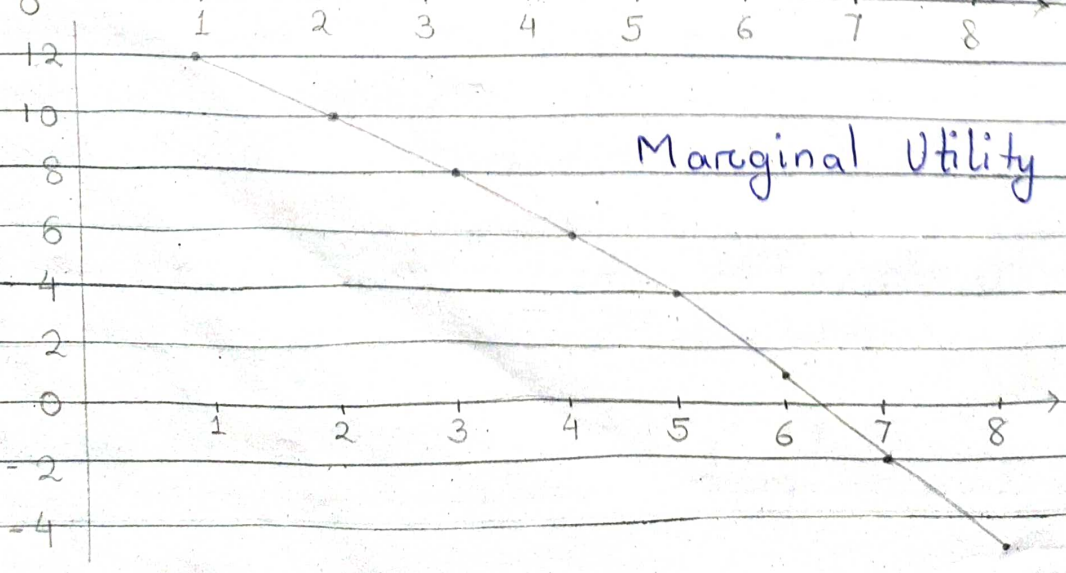
- The law is based on two important facts
  - ✓ Human wants are unlimited but each single want is satiable.
  - ✓ Different goods are not perfect substitutes for each other.

P.T.O

Illustration of the Law of diminishing marginal utility

Cups of Tea/day (Q)	Total Utility (utils)	Marginal Utility ($\Delta TU/\Delta Q$)
1	12	12
2	22	10
3	30	8
4	36	6
5	40	4
6	41	1
7	39	-2
8	34	-5





Marginal utility and consumer's tastes and preferences :

- Utility which people derive from various goods reflects their tastes and preference for them.
- Utility across consumer is not comparable.
- Each consumer has a unique subjective utility scale.
- Consumer's taste and preference is not much time-variant

Significance of diminishing Marginal Utility :

- Because of the diminishing marginal utility, the demand curve slope downward

- The Law applies to all objects in fact, 'money'! But Marginal utility of 'money' will never be zero or Negative.

Why 'water' which is very essential and useful for life has low price but 'Diamonds' which are quite not essential have such a high price?

The more there is of a commodity, the less the relative desirability of its last little unit becomes, even though its ~~amount~~ total usefulness grows as we get more of commodity. So it is obvious why a large amount of ~~bas~~ water has a low price and diamond have such a high price.

Consumer's Equilibrium :

Principle of Equi-marginal utility

- It occupies an important place in cardinal utility analysis.
- It explains consumer's equilibrium.

Assumptions before using the law :

- ✓ ~~Assumptions before using the law.~~
- ✓ A rational consumer
- ✓ It can calculate utilities in numbers for different units of consumption
- ✓ Substitute one good for another to maximise satisfaction.

Defination :

"The law of equi-marginal utility states that the consumer will distribute his money income among the goods in such a way that the utility derived from the last rupee spent on each good is equal".

Consumer's Equilibrium : When marginal utility of money expenditure on each good is the same.

Marginal utility of money expenditure on a good is equal to the marginal utility of a good divided by the price of that good.

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

MU_m = marginal utility of money expenditure
MU_x = marginal utility of commodity x
P_x = Price of commodity x

Now, lets assume there are two commodity x and y.
The consumer is in equilibrium in purchases of two goods when

$$(MU_m)_x = (MU_m)_y$$

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

if $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$: Consumer will substitute good x for good y

if $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$: Consumer will substite good y for good x

Now, if $\frac{MU_x}{P_x} \neq \frac{MU_y}{P_y}$, and $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$, then the consumer will substitute good x for good y, as a result, the marginal utility of good x will fall and marginal utility of y will rise. The consumer will continue this until $(MU_m)_x = (MU_m)_y$ becomes then consumer will be in equilibrium.

$$\boxed{\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_m}{P}}$$

1. Let us assume there are 2 commodity x and y. The unit price for x and y are $P(x)$ and $P(y)$ respectively

$P(x) = 2$ and $P(y) = 3$

Units	Marginal utility of x (in utils)	Marginal utility of y (in utils)
1	20	24
2	18	21
3	16	18
4	14	15
5	12	9
6	10	3

Marginal utility of money expenditure

Units	MU_x / P_x	MU_y / P_y
1	10	8
2	9	7
3	8	6
4	7	5
5	6	3
6	5	1

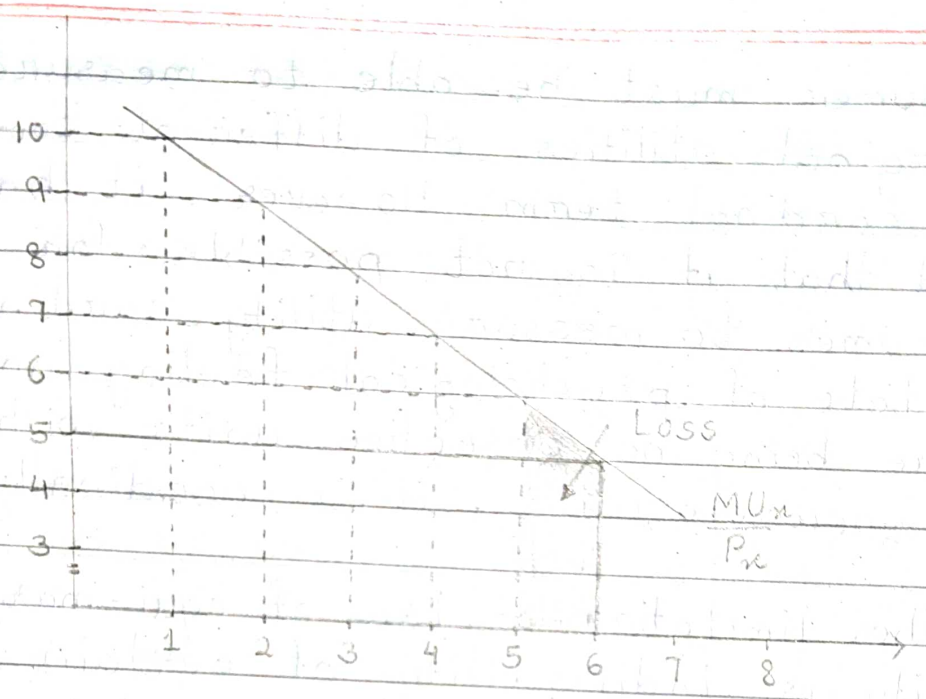
Suppose the fixed money income to spend = ₹24.

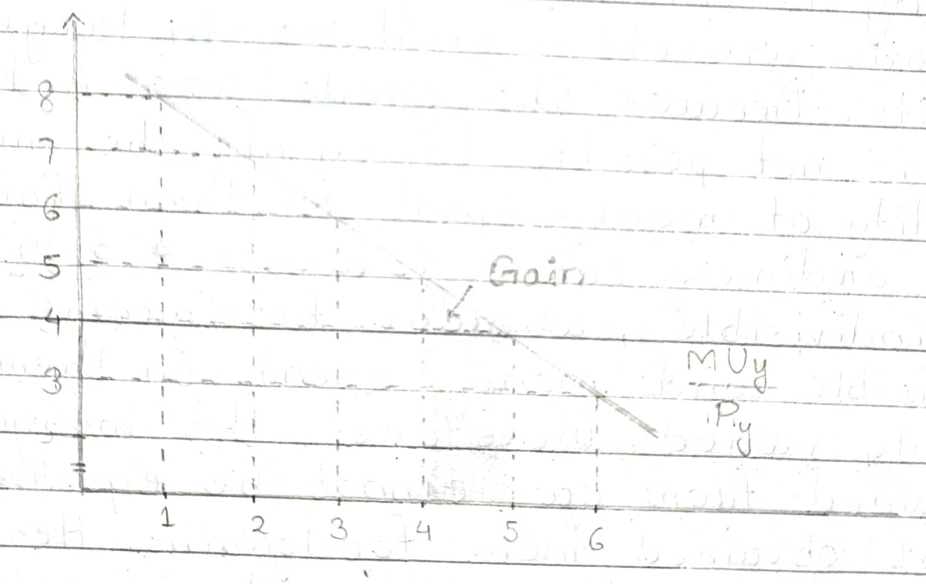
The consumer will equate the marginal utility of last rupee (marginal utility of money expenditure) spent on these two goods

6 units of x (MU_{m_x}) = 5 and 4 units of y (MU_{my}) = 5

Total expenditure = ₹ 2 × 6 units + ₹ 3 × 4 units

= ₹ 24





Limitations of the law :

1. Consumer must weight in his mind the marginal utilities of different commodities. But it has been pointed out that ordinary consumers are not so rational and calculating. Because of their habits and customs they spend a particular amount of money on different commodities, regardless of whether the particular allocation maximises their satisfaction or not.

2. Consumer must be able to measure the marginal utilities of different commodities in cardinal term. However, it has been said that it is not possible for the consumer to measure utility cardinally. Being a state of psychological feeling and also there being no objective units with which to measure utility, it is cardinally immeasurable.

3. Another limitation of law of equi-marginal utility is indivisibility of certain goods. Goods are often available in large invisible units. Because the goods are indivisible, it is not possible to equate the marginal utility of money spent on them. For example, an ordinary car costs about ₹ 3,00,000 and is indivisible, whereas foodgrains are divisible and money spent on them can be easily varied. Therefore, the marginal utility obtained from car cannot be equalised with that obtained from foodgrains. Hence, indivisibility of certain goods is a great obstacle in ~~th~~ equalisation of marginal utility of different commodity.

Ordinal Measurement of Utility

Indifference Curve

It is the locus of various combinations of two commodities which gives same level of satisfaction to consumer.

↳ Composite commodity : A set of goods ~~which~~ whose relative prices do not change, so they can be treated as a single commodity.
↳ Consumer is able to rank commodities.
↳ Consumer ~~is~~ strictly prefers one over another or indifferent between them.

Assumptions of consumer preferences :

* Completeness : Consumer is capable of ranking alternative bundles
* Transitivity : Able to rank all available bundle of goods in a consistent manner.
* More is better : more of a commodity is better than less of it.

Indifference curve Approach

- Ordinal Utility : Consumer is capable of comparing the different level of satisfaction.
- Notions of preference and Indifference :
  ✓ The consumer cannot go beyond stating his preference or indifference
  ✓ Consumer formulates his scale of preferences independently of the market price.

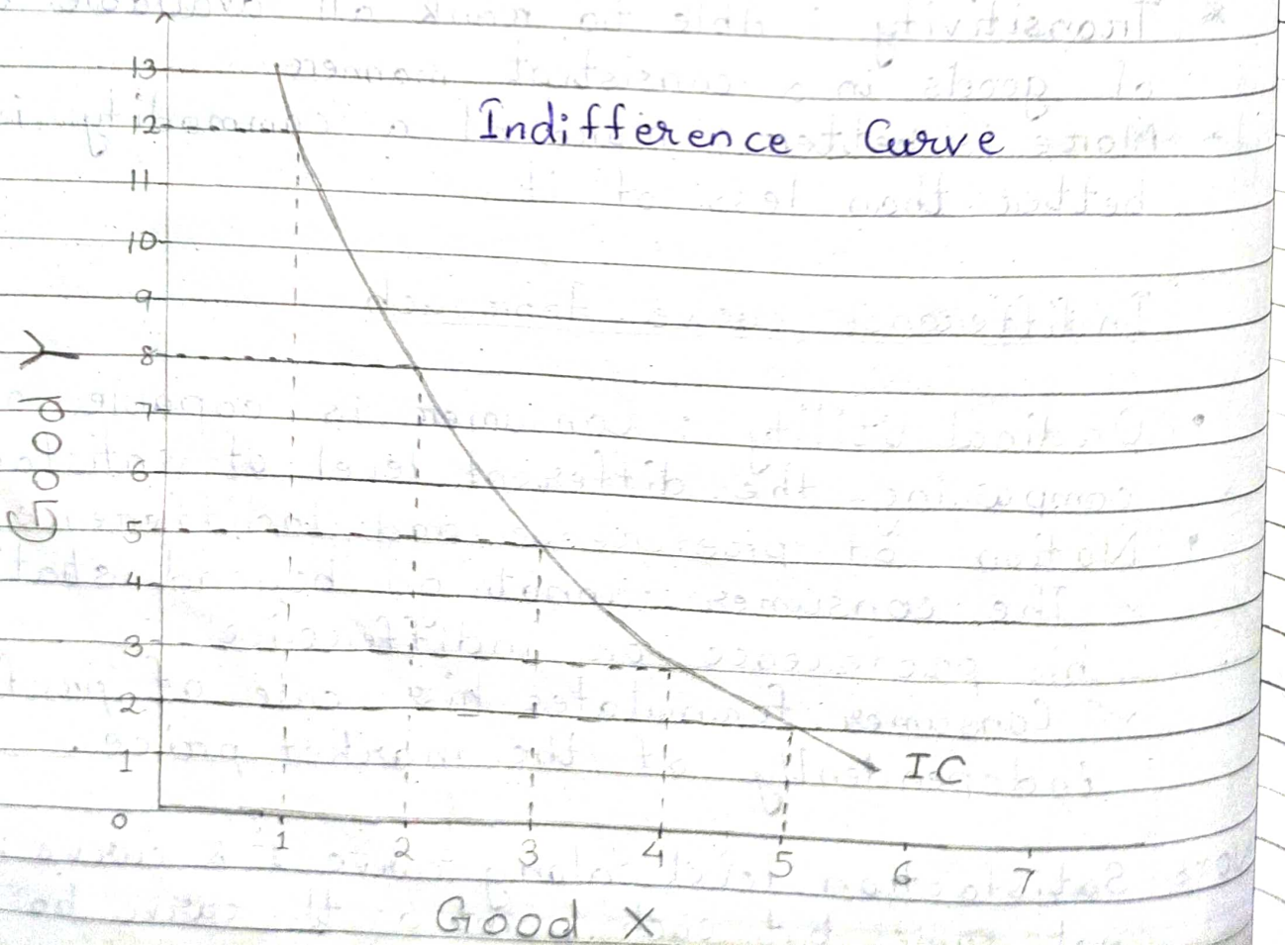
NOTE Satisfaction level along curve 1 & curve 2 are not same but each point on the curve has same level of satisfaction.

Assumptions :

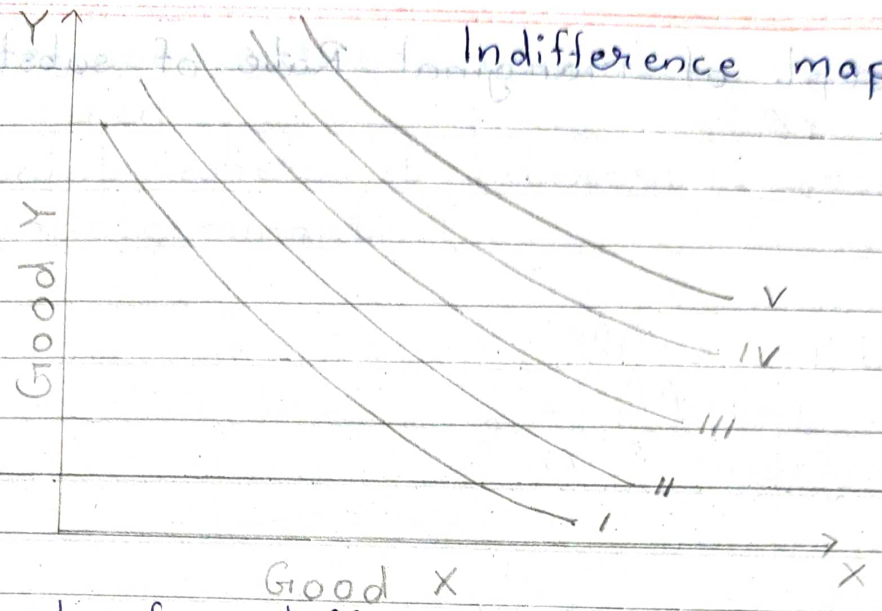
1. More of a commodity is better than less.
2. Preferences or indifferences of a consumer are transitive.
3. Diminishing marginal rate of substitution

Two indifference schedule :

1		2	
Good X	Good Y	Good X	Good Y
1	12	2	14
2	8	3	10
3	5	4	7
4	3	5	5
5	2	6	4



Indifference map



It is set of indifference curve

Marginal Rate of Substitution (MRS)

Marginal rate of substitution of good-x for good-Y is the amount of Y whose loss can just compensate the consumer for one unit gain in X.

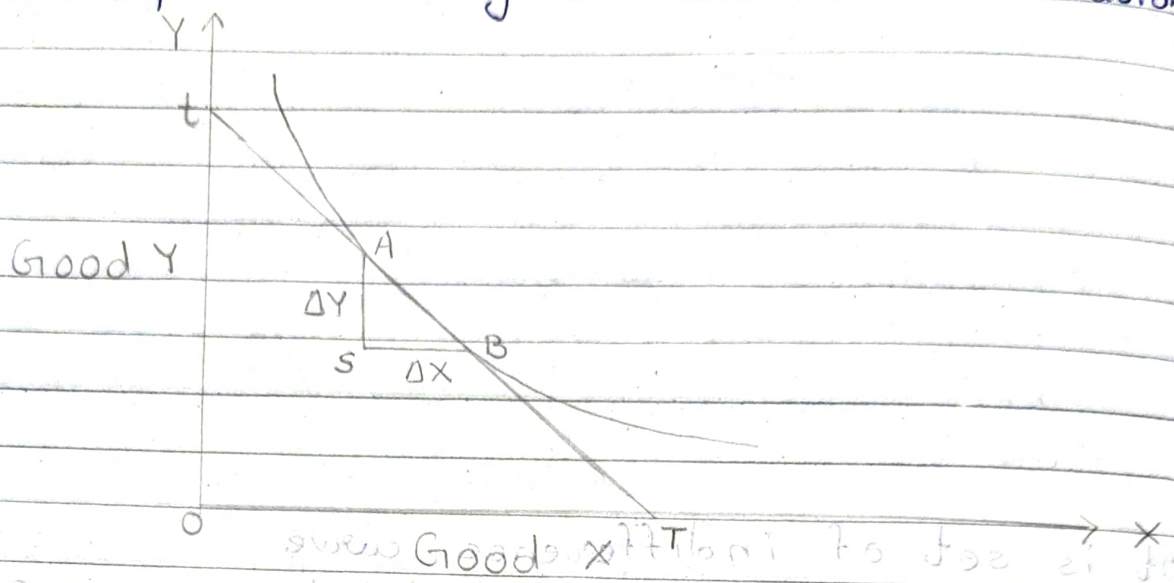
In other words, for an additional unit of good X, how much unit of good Y has been given by consumer.

$$MRS\text{-}XY = \frac{\Delta Y}{\Delta X}$$

Combination	Good X	Good Y	MRS X for Y
A	1	12	
B	2	8	4
C	3	5	3
D	4	3	2
E	5	2	1

Indifference schedule

Concept of Marginal Rate of substitution (MRS)

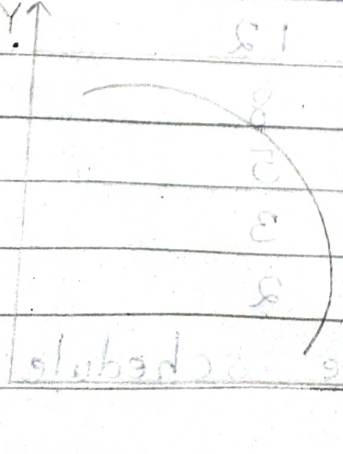


Why marginal rate of substitution decreases?

Ans. The want for a particular good is satiable so that as the consumer has more and more of a good, the intensity of his want for that good goes on declining. Another reason is that the goods are imperfect substitute for each other.

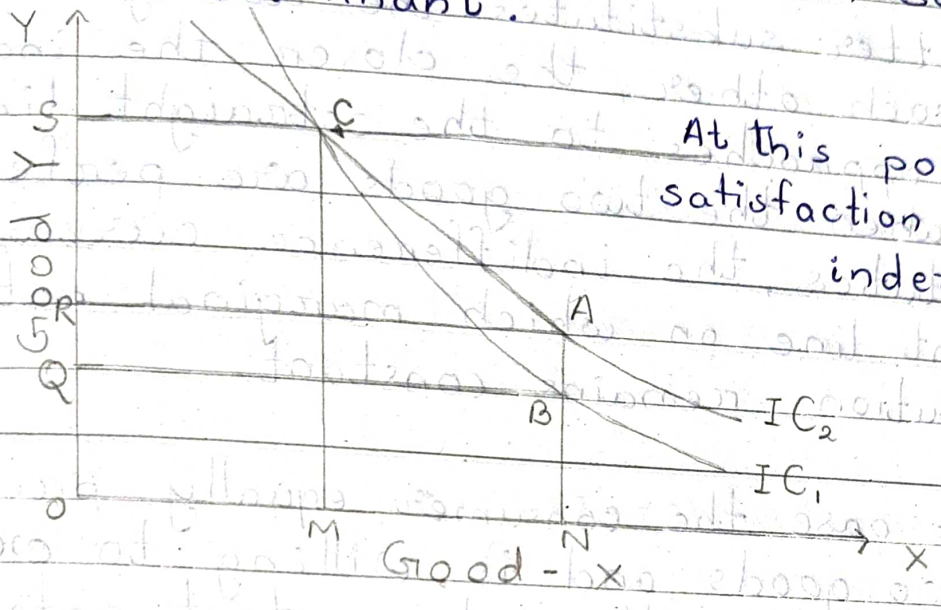
Properties of Indifference curve :

1. Indifference curve slope downward to the right.
2. Indifference curves are convex to the origin.



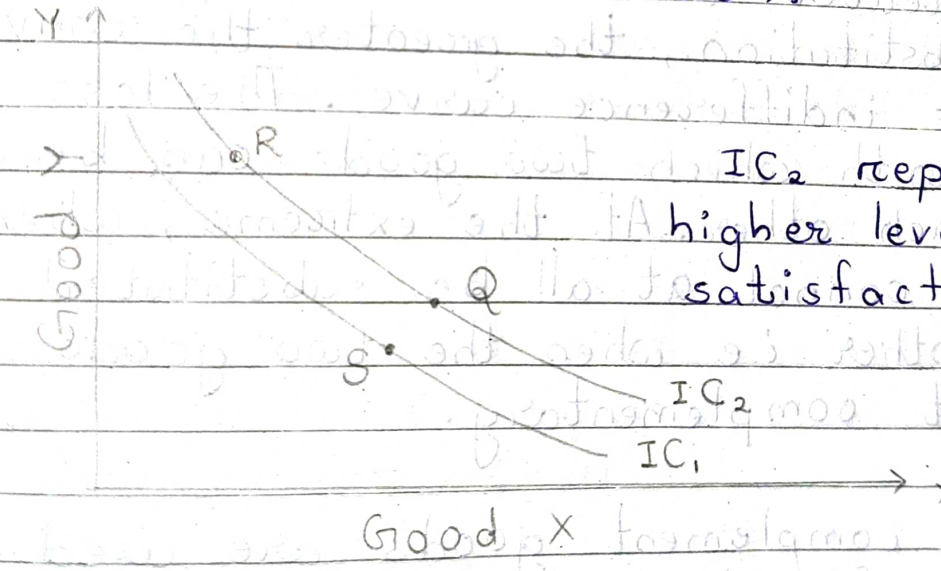
If it is concave to the origin, then MRS increases. i.e the consumer will buy only one good.

3. Indifference curves cannot intersect each other.
The point where it interect, satisfaction is indeterminant.



At this point, the satisfaction is indeterminant

4. Higher indifference curves represents higher level of satisfaction.



IC_2 represents higher level of satisfaction.

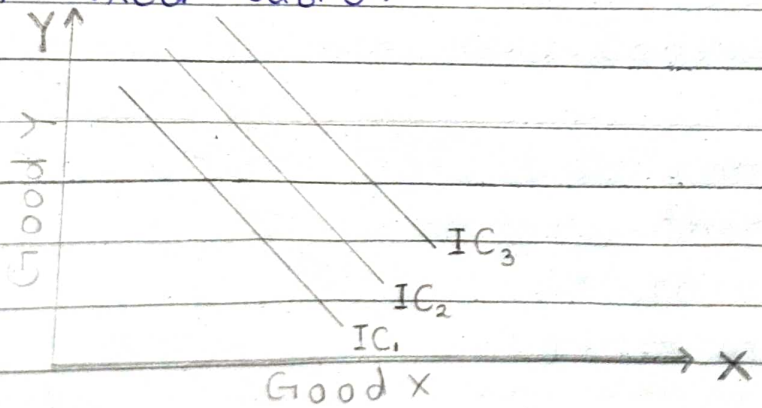
Indifference curves of perfect substitutes and perfect complements

The better substitutes the two goods are for each other, the closer the indifference curve approches to the straight line, so that when the two goods are perfect substitutes, the indifference curve is a straight line on which marginal rate of substitution remains constant.

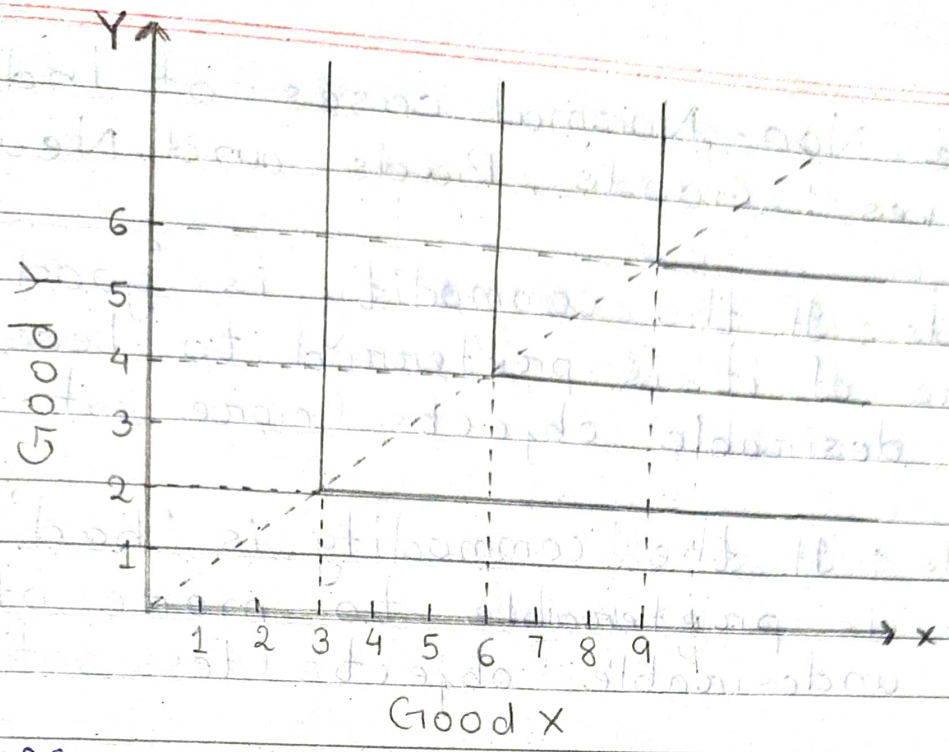
In this case the consumer equally prefers the two goods and is willing to exchange one good for other at constant rate.

The greater the fall in marginal rate of substitution, the greater the convexity of the indifference curve. The less the ease with which two goods can be substitute for each other. At the extreme, when two goods cannot at all be substituted for each other i.e when the two goods are perfect complementary.

Note Perfect complement goods are used in a certain fixed ratio.



Indifference curve of Perfect Substitute



Indifference curve of perfect complements

The left-hand portion of an indifference curve of perfect complement good is vertical straight line which indicates that an infinite amount of Y is necessary to substitute one unit of X and right hand portion ~~sh~~ i.e horizontal straight line shows vice versa of former one.

All this means that two perfect complements are used in fixed ratio and cannot be substituted for each other.

In the above fig. the ratio is 3X : 2Y

"Complements are thus those goods which are used jointly in a fixed ratio in consumption so that their consumption increases or decreases simultaneously."

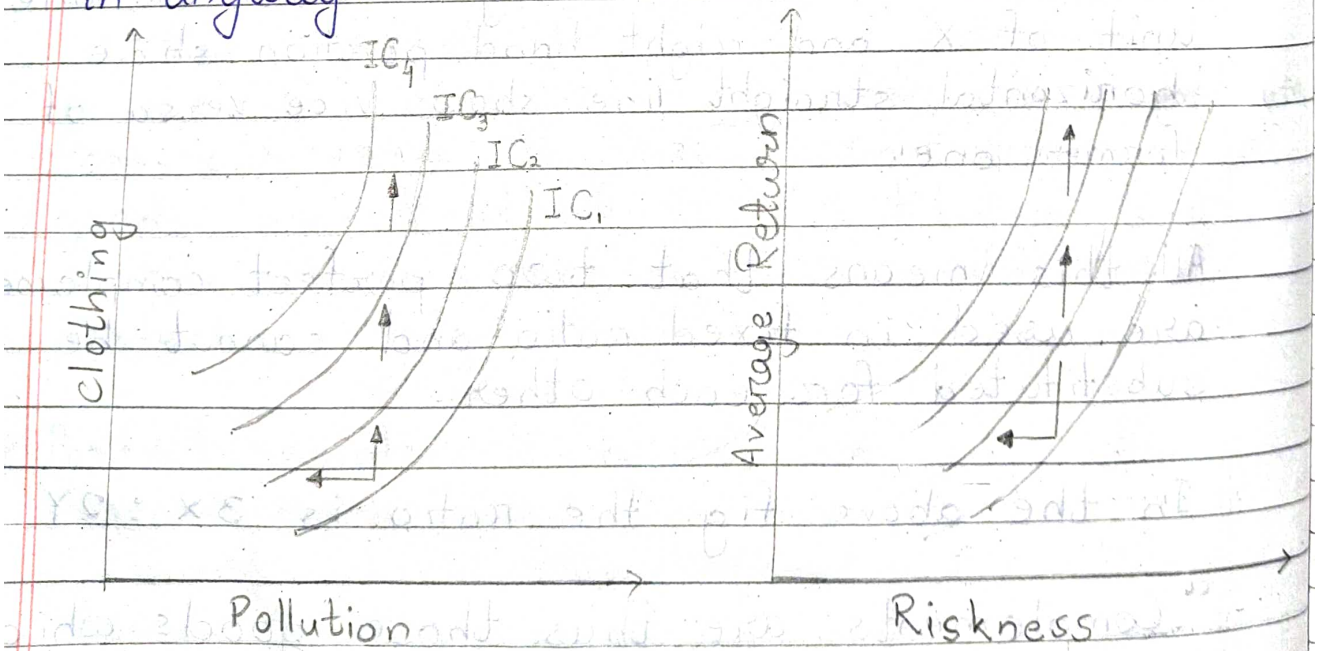
Ex: Pen and ink, automobile and petrol

Some Non-Normal cases of Indifference curves : Goods, Bads and Neuters

Goods : If the commodity is 'good' then more of it is preferred to less of it. i.e desirable objects (more satisfaction)

Bads : If the commodity is 'bad' then less is preferable to more of it. i.e undesirable objects (less satisfaction)

Neuter : A commodity can be neuter (neutral good) in which case the consumer does not care whether he has more or less of that commodity. That is more or less of neuter does not affect his satisfaction in anyway.



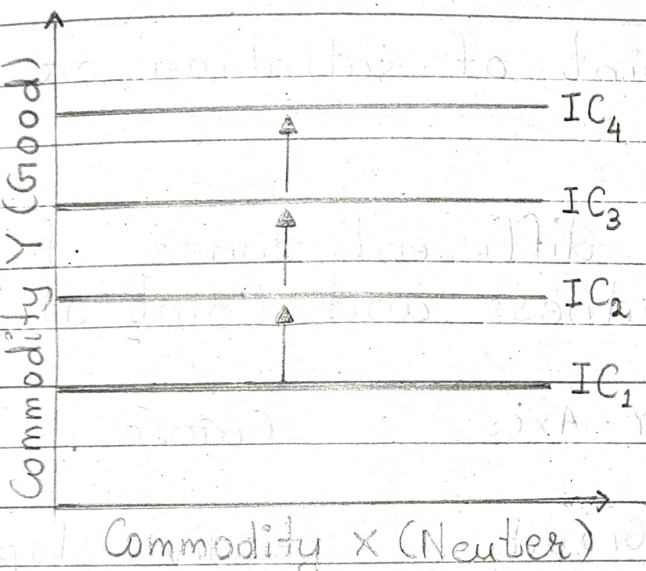
Indifference curves between Bad and Good

+ve slope

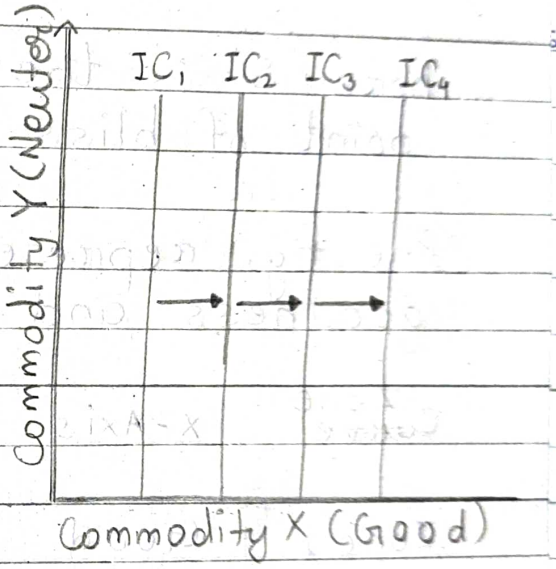
Indifference curves between Riskness and Average return

+ve slope

Suppose a bad is represented in X-axis and good is represented in Y-axis, then the indifference curve will be sloping upward. This is because in this case a movement towards the right along indifferene curve reduce consumer's satisfaction and therefore in order to keep his level of satisfaction constant, the quantity of 'good' (Y-axis) will have to be increased. (+ve curve)



Indifference curves between Neuter and Good

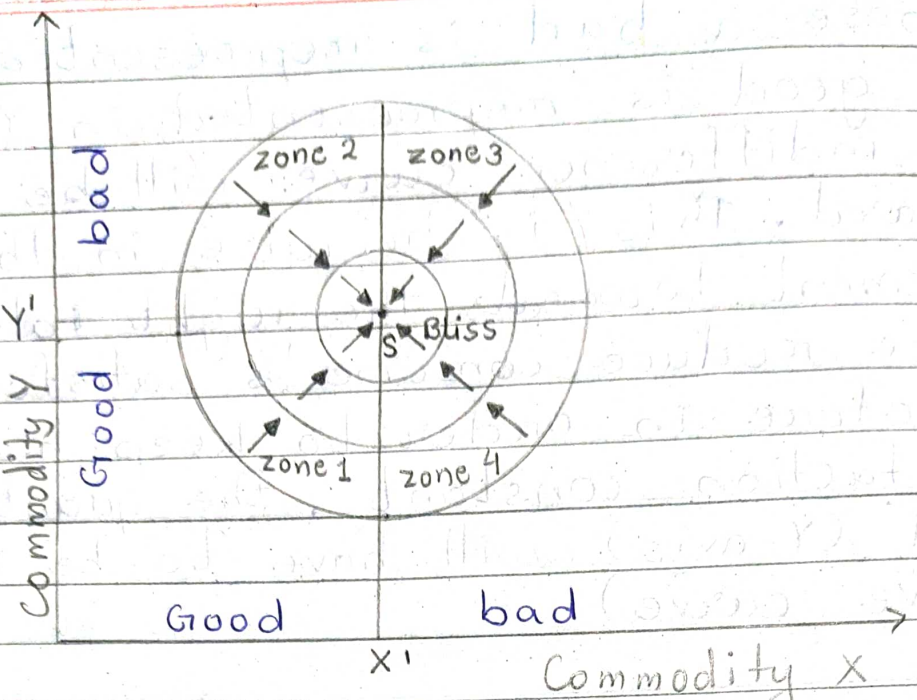


Indifference curves between good and neuter

Satiation and Point of Bliss

A commodity can be good only upto a point called the point of satiation and becomes bad for a consumer if he is forced to increase his consumption beyond that point.

Point of bliss is the centre of the circular indifference curve which represent point of satiation.



here 'S' is the point of satiation or point of bliss

The fig. represent different zones of goodness and badness and Point of bliss

~~Curve~~ Zone	X-Axis	Y-Axis	Curve
Zone 1	Good	Good	negative slope
Zone 2	Good	bad	Positive slope
Zone 3	bad	bad	negative slope
Zone 4	bad	good	positive slope

From the graph, we get that a consumer has some optimal or most preferred combination of commodities and closer he is to that combination, the better off he is.

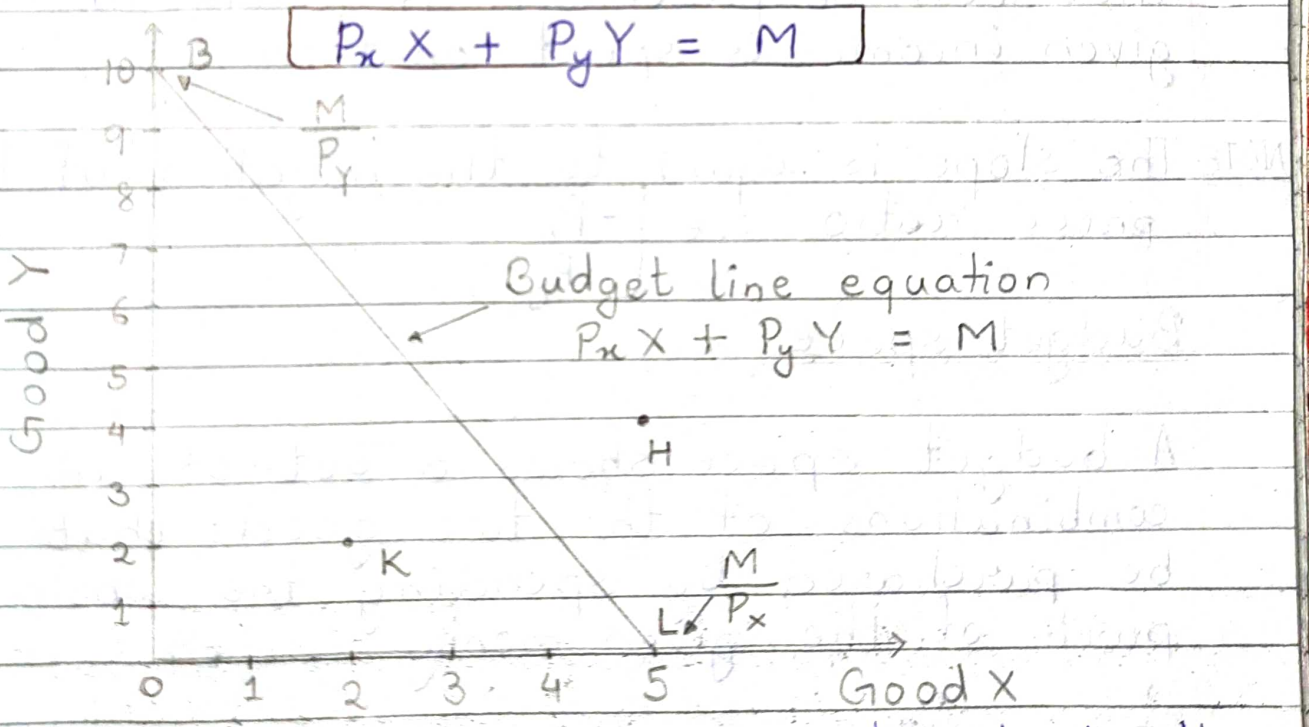
Budget line or budget constraint

All those combinations of two goods which the consumer can buy by spending his given money income on the two goods at their given price

Now, a consumer in his attempt to maximise his satisfaction will try to reach highest possible indifference curve. But in this he has to work under two constraints
i) He has to pay prices for goods.
ii) He has a limited money income

Equation for budget line:

$$P_x X + P_y Y = M$$



Point H which lies above and outside the given budget line will be beyond the reach of the consumer.
Point K which lies within the budget line will be within reach of consumer.

The intercept OB on Y-axis is equal to

$$OB = M/P_y = \frac{\text{Entire income}}{\text{Price of commodity Y}}$$

The intercept OL on X-axis is equal to

$$OL = M/P_x = \frac{\text{Entire income}}{\text{Price of commodity X}}$$

from the graph we get that every combination lying on the budget line will cost the same amount of money and therefore can be purchased with the given income.

defination: Budget line can be defined as a set of combination of two commodities that can be purchased if whole of the given income is spent on them.

NOTE The slope is equal to the negative of the price ratio i.e $\boxed{\frac{-P_x}{P_y}}$

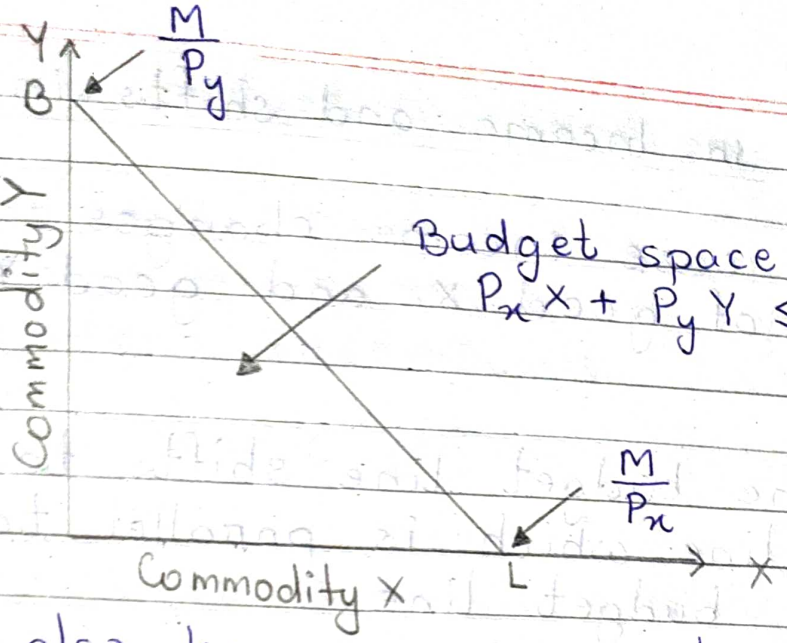
Budget space

A budget space shows a set of all combinations of the two goods that can be purchased by spending the whole or part of the given money

The equation for budget space

$$\boxed{P_x X + P_y Y \leq M}$$

It is the entire area enclosed by budget line.



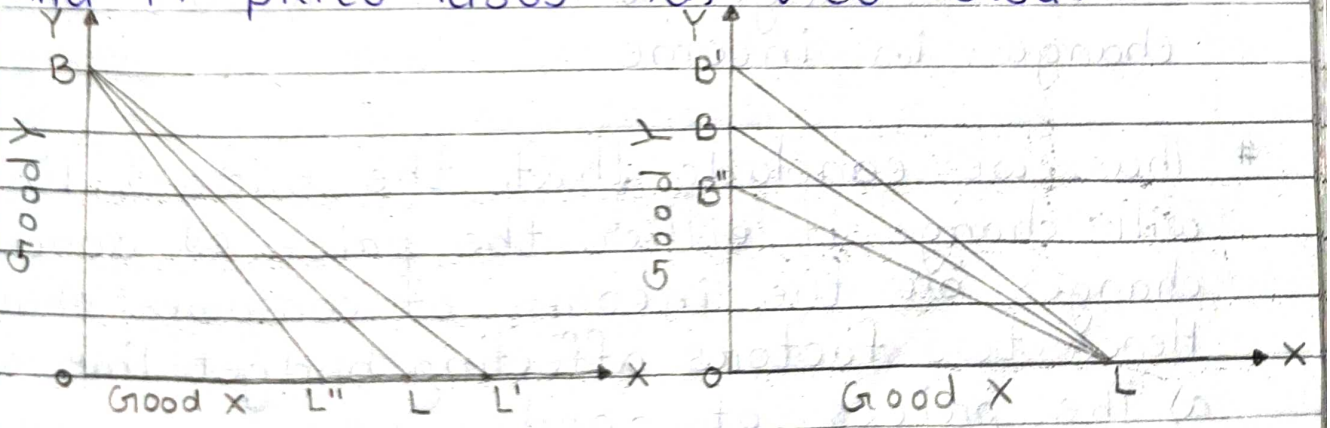
It is also known as opportunity set

a) Changes in price and shift in Budget line

If price of X falls, and price of Y and income remaing constant. Now with lower price of X the consumer will be able to purchase more quantity of X.

Similarly if price of Y falls and price of X and income remain constant. Now with lower price of Y the consumer will be able to purchase more quantity of Y.

And if price rises then vice versa.



Changes in budget line as a result of change in price of Good X

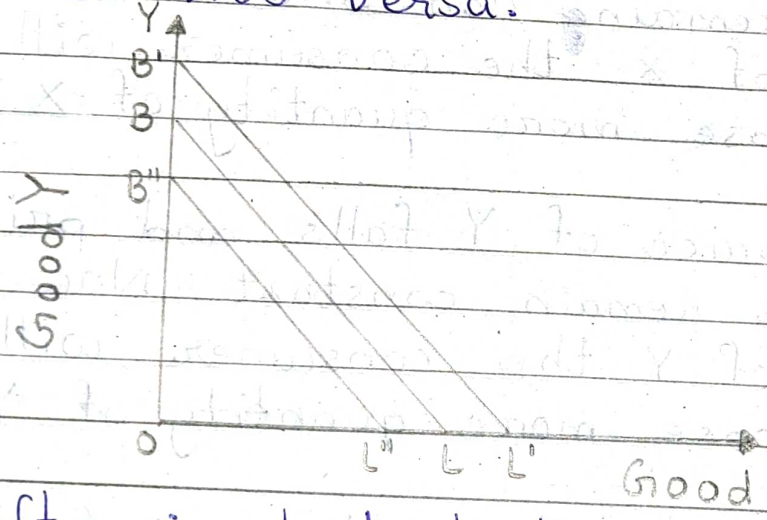
Changes in budget line as a result of change in price of Good Y

b) Changes in Income and shifts in Budget Line

In this case income changes, while the prices of good X and good Y remain same.

Here the budget line shifts to a new budget line which is parallel to the original budget line.

This happens because with the increased income the consumer is able to purchase proportionately larger quantity of each good X and Y. If the income decreases then vice versa.



Shifts in budget line as a result of changes in income

Thus we conclude that the budget line will change if either the price of goods changes or the income of consumer changes. Hence two factors affecting budget line are

a) The prices of goods
b) The consumer's income

Slope of budget line and price of goods

P_x = Price of good X
P_y = Price of good Y
M = money income

$$P_x X + P_y Y = M$$

X = total quantity of good-X
Y = tatal quantity of good-Y

$$X = \frac{M}{P_x}$$

$$Y = \frac{M}{P_y}$$

$$\text{Slope of budget line} = -\frac{P_x}{P_y}$$

Consumer's Equilibrium
[Maximising Satisfaction]

A consumer is said to be in equilibrium when he is buying such a combination of goods as leaves him with no tendency to rearrange his purchases of goods.

As in the cardinal utility analysis, in the indifference curve analysis also it is assumed that the consumer tries to maximise his satisfaction.
In other words, the consumer is assumed to be rational in the sense that he aims

at maximising his satisfaction.

Consumer is in a position of balance in regards to the allocation of his money expenditure among various goods.

Assumptions :

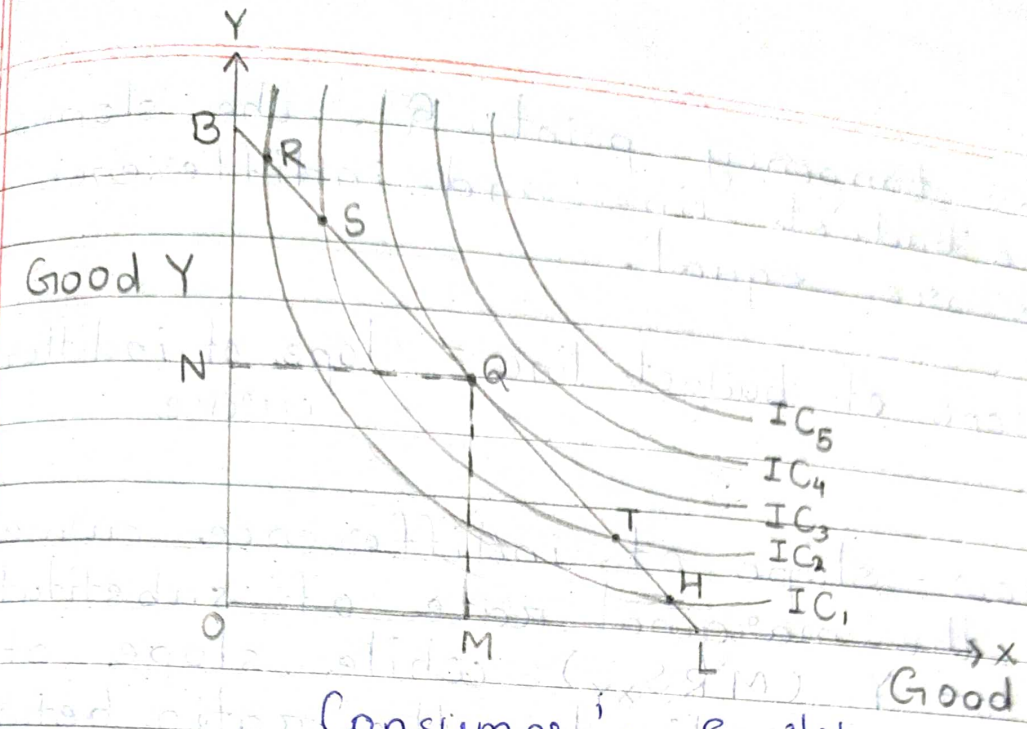
- Consumer has a given indifference map exhibiting his scale of preferences for various combinations of two goods x and Y.
- Fixed amount of money to spend on two goods
- Prices of goods are given and constant
- Goods are homogeneous and divisible.

homogeneous means similar in every aspects
divisible means a wholesome

- Tastes and preferences of consumer remain constant
- The consumer seeks maximum satisfaction.

★ To keep the consumer in equilibrium position, his indifference map and budget line are brought together.

In order to maximise his satisfaction the consumer will try to reach the highest possible indifference curve which he could with a given expenditure of money and given prices of two goods.
Budget constraint forces the consumer to choose a combination from among only those which lies on the given budget line.



Consumer's Equilibrium graph
(necessary condition)

Graph shows various combinations of two goods lying on the budget line BL

The consumer will choose that combination on the budget line which lies on the highest ~~indifference~~ possible indifference curve.

The highest indifference curve to which the consumer can reach is the indifference curve to which the budget line is tanget

Any other possible combination of two goods either would lie on a lower indifference curve and thus would yield less satisfaction or would be unattainable.

In the graph, IC_1, IC_2 and IC_3 are only attainable because they lies on the budget line whereas IC_4 and IC_5 are unattainable as they does not lie on the budget line.

At the tangency point Q, the slopes of the budget line and indifference curve are equal.

i.e slope of budget line = slope of indifference curve

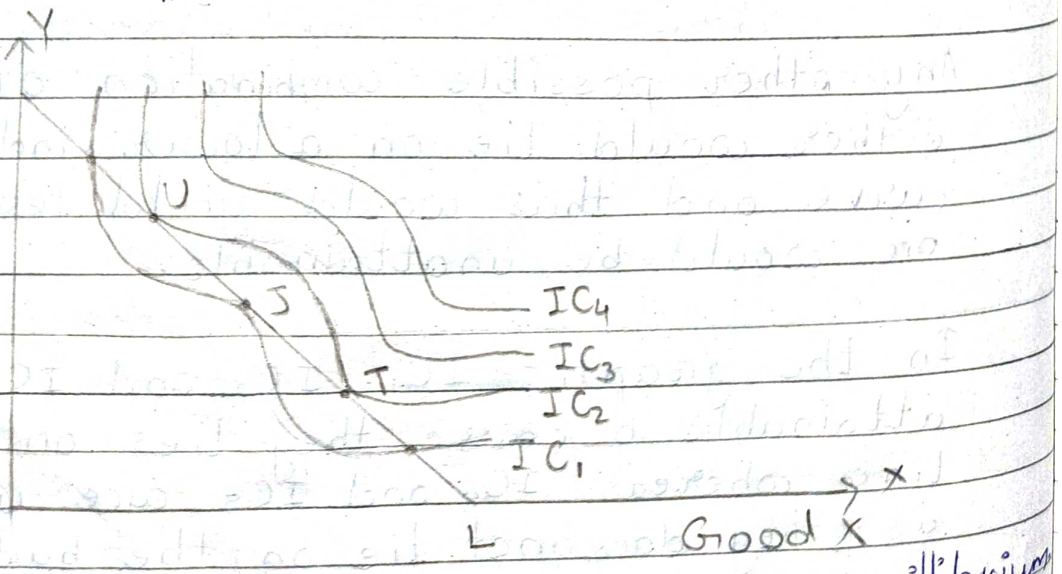
we know, slope of indifference curve shows the marginal rate of substitution of X for Y (MRS_{xy}) while slope of budget line indicates the ratio between prices of two goods.

So, the equilibrium condition is

1. $$\frac{P_x}{P_y} = \frac{\Delta Y}{\Delta X}$$

i.e slope of budget line = slope of I.C

2. Indifference curve must be convex to the origin at the point of equilibrium or MRS must be decreasing at the point of equilibrium.

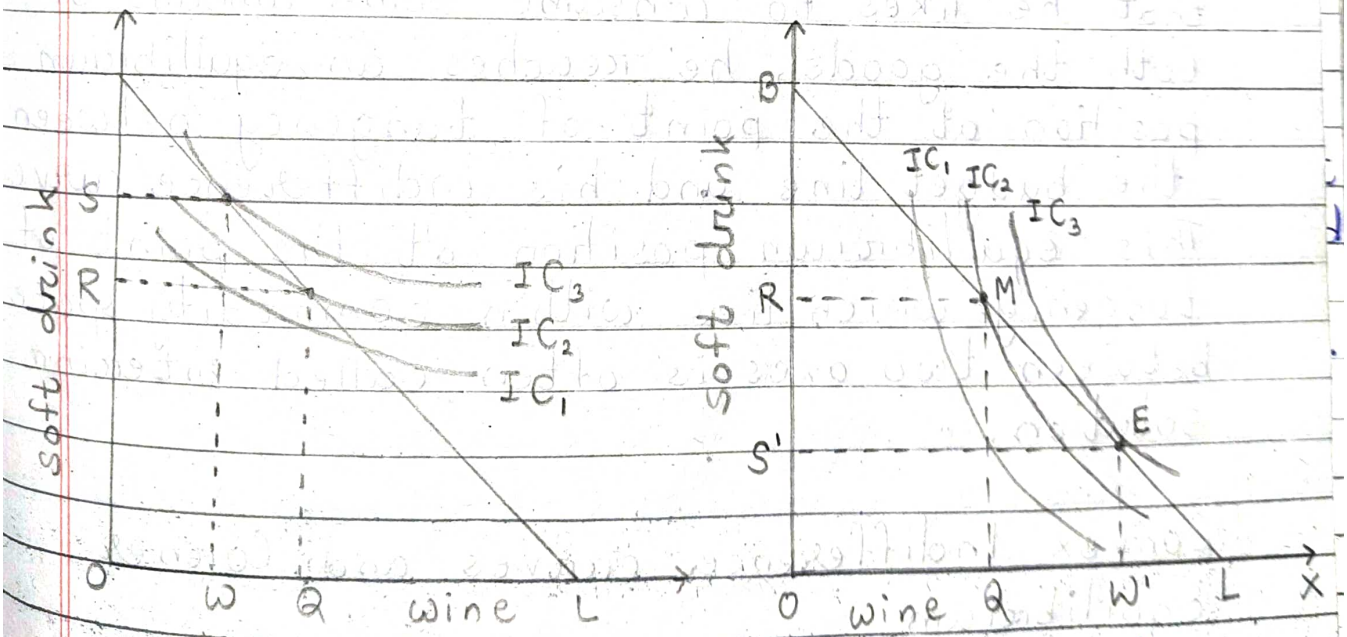


Second order condition for consumer's equillibrium or sufficiet condition

In this indifference curve analysis of consumer's equilibrium no use of cardinal utility concept has been made which implies that satisfaction or utility obtained from the goods is measurable in the quantitative sense.

Differences in Preferences and Consumer's Equilibrium and Choice of goods

The differences in shapes of indifference curves (IC) of the individuals causing difference in their marginal rates of substitution of one good for another at any given market basket of goods furnish us with the information about their preferences and tates for goods.



Amit's preference Rajiv's preference

Graph: Influence of difference in preferences on Consumer's Choice

From graph it is clear that both the individuals are not in equilibrium. This is because :

a) Marginal rate of substitution of wine for soft drink is lower than the price ratio of two goods ~~in~~ for Amit

b) Marginal rate of substitution of wine for soft drink is greater than the price ratio of two goods for Rajiv

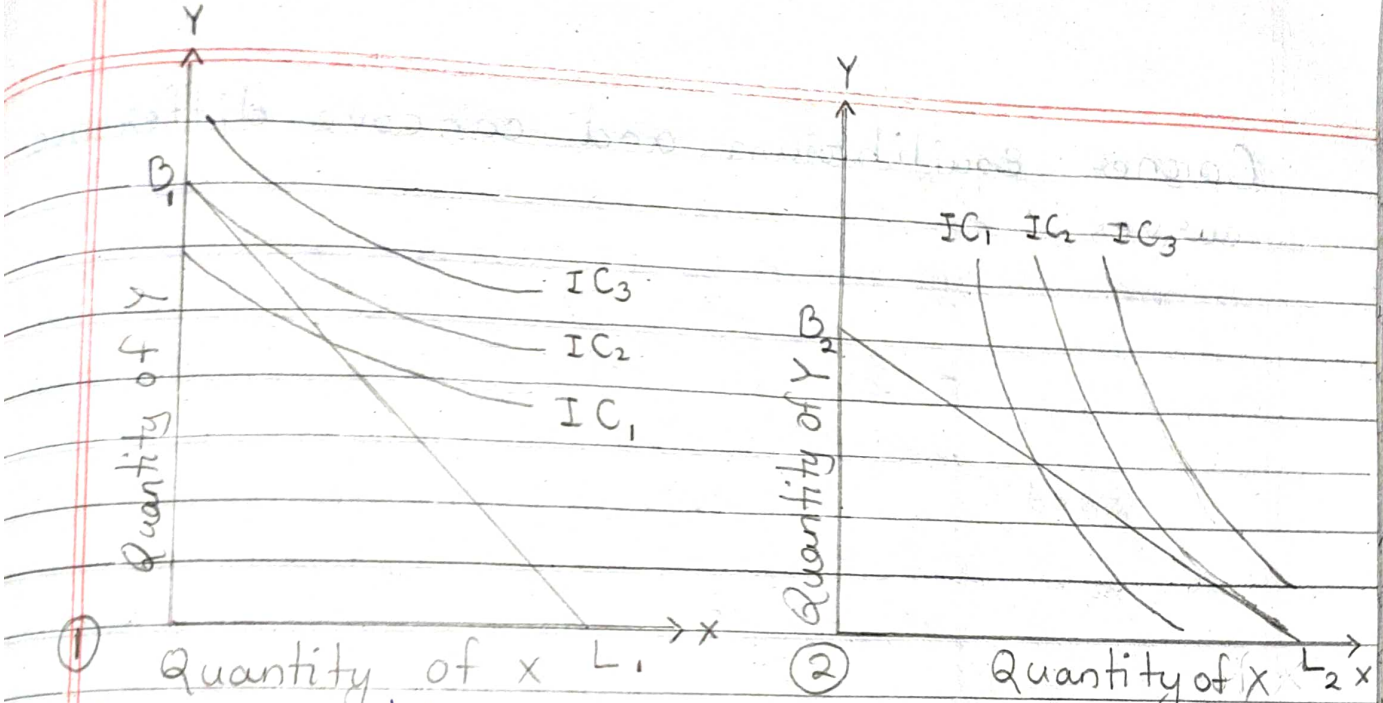
Thus choice of goods by two individuals are determined by their respective preferences between the two goods.

Consumer's Equilibrium : Corner Solutions

When a consumer's preferences are such that he likes to consume some amount of both the goods, he reaches an equilibrium position at the point of tangency between the budget line and his indifference curve. This equilibrium position at the point of tangency which lies within commodity space between two axes is often called interior solution.

Convex Indifference curves and Corner Equilibrium

The reason for not purchasing a commodity by a consumer may be that the price of that particular commodity may be too high for him.



Corner equilibrium in case ~~con~~ of convex indifference curves : Only commodity Y is bought

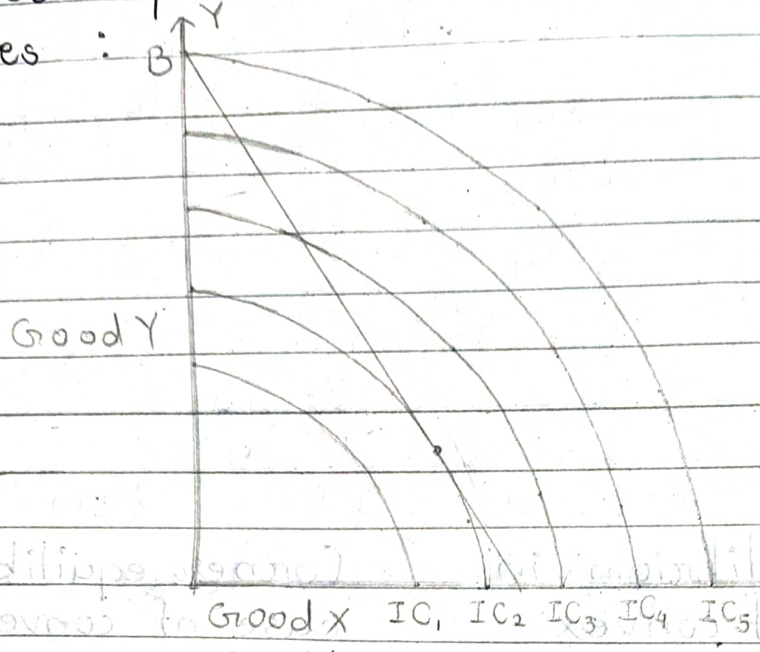
Corner equilibrium in case of convex In-difference curves : Only commodity x is purchased.

In the above graph, the indifference map between two goods X and Y and budget line BL are such that the interior solution is not possible and consumer in its equilibrium position at point B_1 in fig. 1 and at point L_2 in fig 2 and will not consume any quantity of commodity X in fig 1 and Y in fig 2.

This is because the price of commodity X and Y in respective fig is so high that budget line is steeper than the indifference curve.

Therefore, he maximizes his satisfaction at the corner point B_1 and L_2 where he buys only commodity Y and X respectively

Corner Equilibrium and concave difference curves :



Consumer Equilibrium in case of concave indifference curve

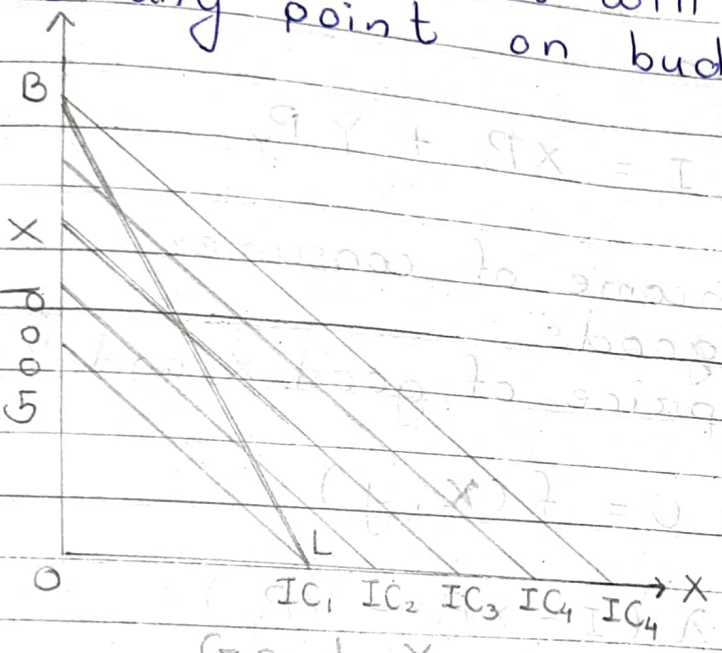
When the indifference curves are concave, consumer's equilibrium will inevitably be a corner solution.

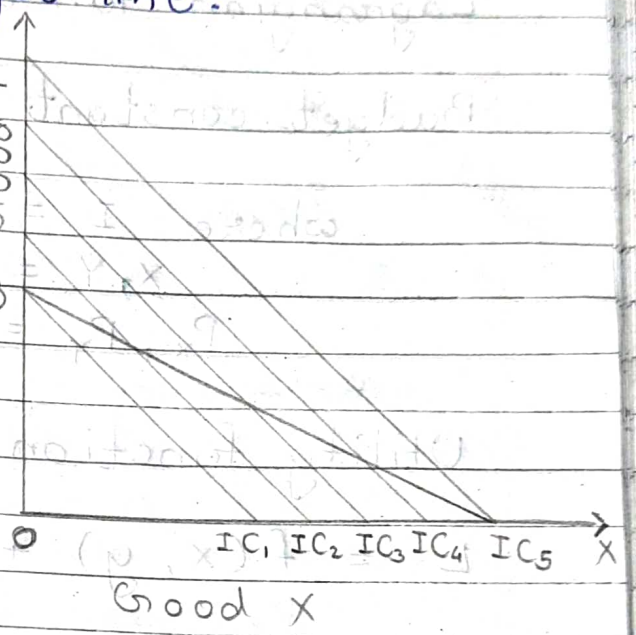
Corner Solution in case of perfect substitute and perfect complimets

Indifference curve for perfect substitutes are linear, so tangency or interior solution for consumer's equilibrium is not possible. Since the budget line cannot be tangent to a point on straight-line indifference curve.

Here we can have two possibilities. either the slope of budget line BL can be greater than the slope of indifference curve or the slope of budget line can be less than the slope of indifference curve:

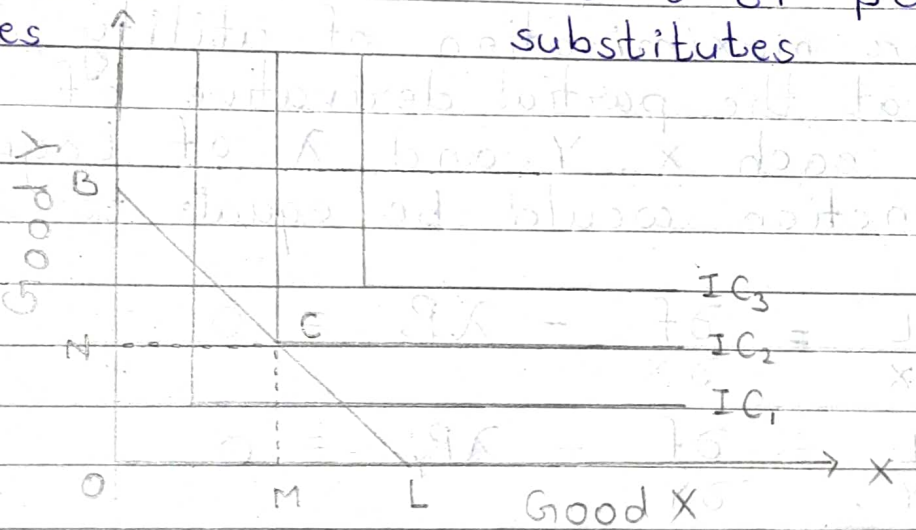
It should be noted that on ~~e~~ both the curves consumer will not be in equilibrium at any point on budget line.





Corner Equilibrium in case of perfect substitutes

Corner Equilibrium in case of perfect substitutes



In case of perfect compliments equilibrium exists at the corner of an indifference curve.

In the above graph, the equilibrium of the consumer will be determined at the corner point of indifference curve IC_2 which is just touching the budget line BL at point C. It is the highest IC to which consumer can go.

Derivation of consumer's Equilibrium

Lagrangian function

Budget constant : $I = XP_x + YP_y$

where I = Income of consumer
X, Y = goods
P_x, P_y = price of good X and Y

Utility function : $U = f(x, y)$

$L = f(x, y) + \lambda (I - XP_x - YP_y)$

λ = Lagrangian multiplier

For maximisation of utility, it is necessary that the partial derivative of L with respect to each X, Y and λ of Lagrangion function would be equals to zero.

$$\frac{\partial L}{\partial X} = \frac{\partial f}{\partial X} - \lambda P_x = 0$$

$$\frac{\partial L}{\partial Y} = \frac{\partial f}{\partial Y} - \lambda P_y = 0$$

$$\frac{\partial L}{\partial \lambda} = I - XP_x - YP_y = 0$$

Problem :

1. Utility function of an individual is given by $U = f(X, Y) = X^{3/4} \cdot Y^{1/4}$. Find out the optimal quantities of the two goods X and Y using Lagrangian method, if it is given that price of good X, $P_x = ₹ 6$/unit

price of good Y, P_Y = ₹ 3 per unit
and Income of individual I = ₹120

Solution

Budget constant : $I = XP_x + YP_Y$

$$120 = 6X + 3Y \quad - ①$$

$$L = f(x, y) + \lambda(I - XP_x - YP_Y)$$

$$L = x^{3/4} y^{1/4} + \lambda(120 - 6X - 3Y)$$

$$\frac{\partial L}{\partial X} = \frac{3}{4} x^{-1/4} y^{1/4} - 6\lambda = 0 \quad - ②$$

$$\frac{\partial L}{\partial Y} = \frac{1}{4} x^{3/4} y^{-3/4} - 3\lambda = 0 \quad - ③$$

Now, From eq ② and ③ we get

$$\frac{3}{4}\left(\frac{y}{x}\right)^{1/4} - 6\lambda = 0$$

$$\frac{1}{4}\left(\frac{x}{y}\right)^{3/4} - 3\lambda = 0$$

so, $\frac{3}{4}\left(\frac{y}{x}\right)^{1/4} = 2 \times 3\lambda$

$$\frac{1}{4}\left(\frac{x}{y}\right)^{3/4} = 3\lambda$$

$$\Rightarrow \frac{3}{4}\left(\frac{y}{x}\right)^{1/4} = 2 \cdot \frac{1}{4}\left(\frac{x}{y}\right)^{3/4}$$

$$\Rightarrow \frac{3}{2}\left(\frac{y}{x}\right)^{1/4} \times \left(\frac{y}{x}\right)^{3/4} = 1$$

$$\Rightarrow \frac{3}{2}\frac{y}{x} = 1$$

$$\Rightarrow 3y = 2x \quad - ④$$

Now solving eqⁿ ① and ④

$$120 = 6x + 3y$$

$$120 = 6x + 2x$$

$$8x = 120$$

$$x = 15$$

$x = 15$

$3y = 2x$

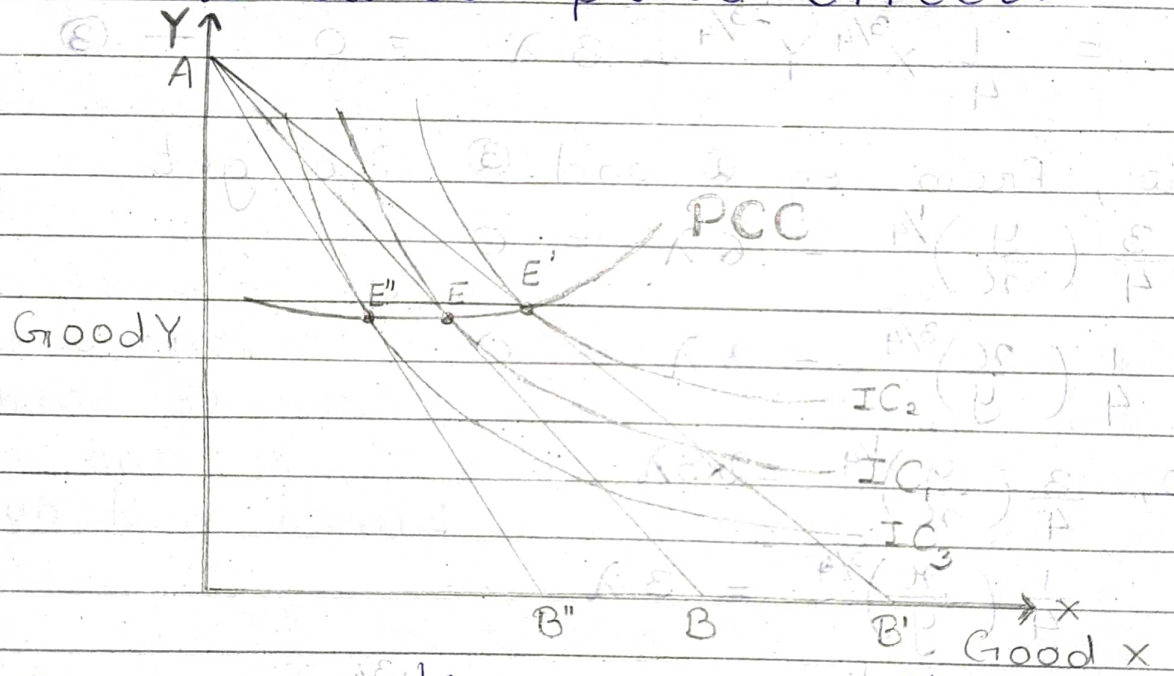
$3y = 2 \times 15$

$y = 10$

Hence, the optimal quantities of the two goods are $x = 15$, $y = 10$

Price Effect and Price Consumption Curve

The movement from one curve to another curve is called price effect.



Price consumption curve is the locus of different equilibrium points of consumer which are due to change in price of commodity.

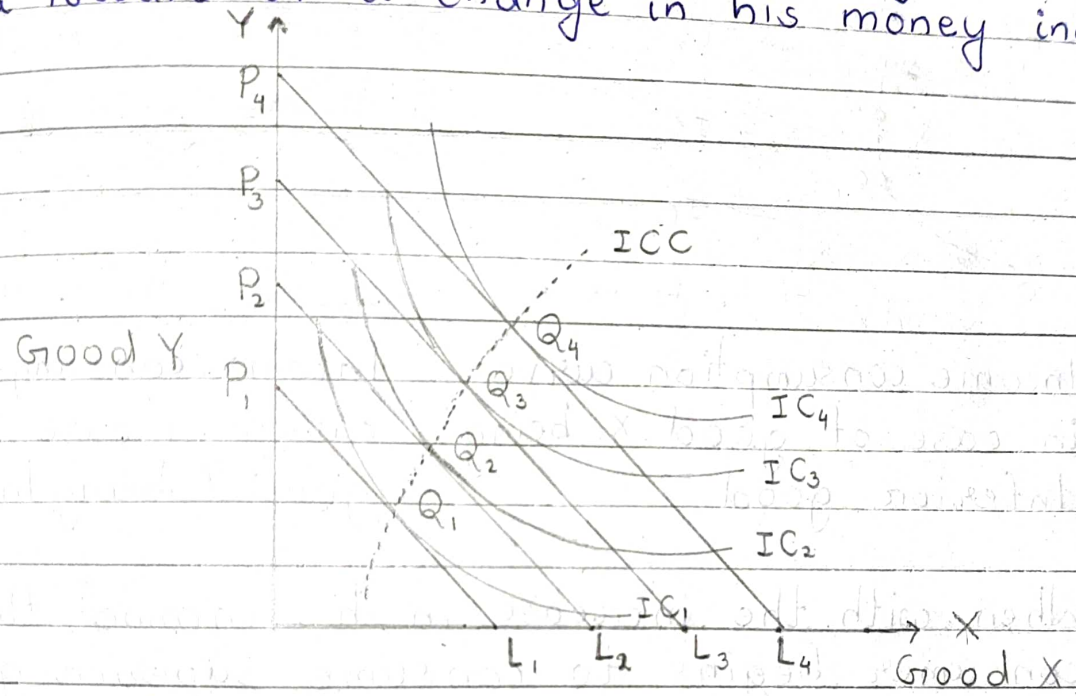
downward sloping PCC : $e_p > 1$ (elastic)

upward sloping PCC : $e_p < 1$ (inelastic)

e_p = price elasticity

Income Effect and Income consumption curve (ICC).

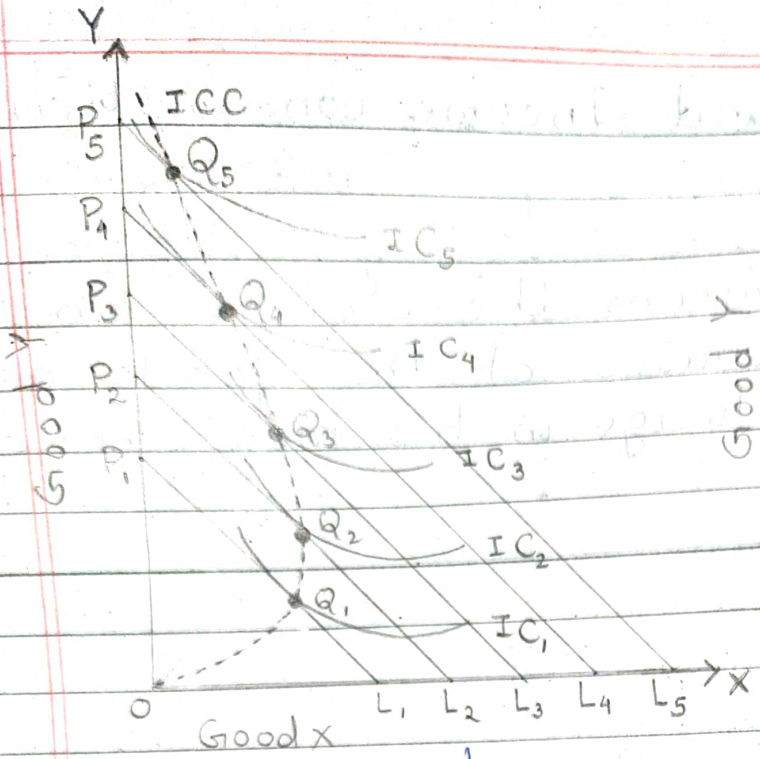
Income effect means the change in consumer's purchases of the goods as a result of a change in his money income.



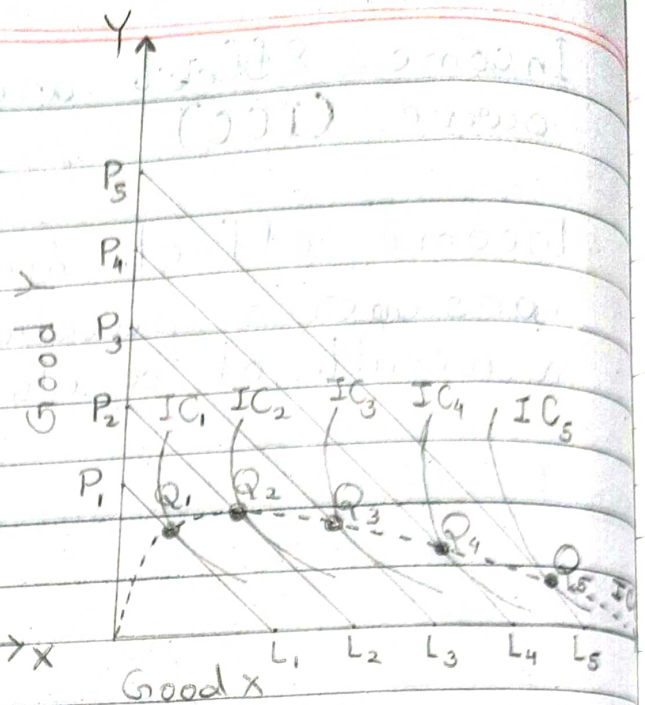
Income consumption curve: Income effect

Income consumption curve traces out the income effect on the quantity consumed of the goods. Income effect can either be positive or negative. Income effect for a good is said to be positive when with increase in income of the consumer, his consumption of the good also increases. This is normal good case.

Income effect for a good is said to be negative when with the increase in the consumer's income, the consumer reduces his consumption of the good. Such goods for which income effect is negative are called inferior goods.



Income consumption curve in case of good X being Inferior good

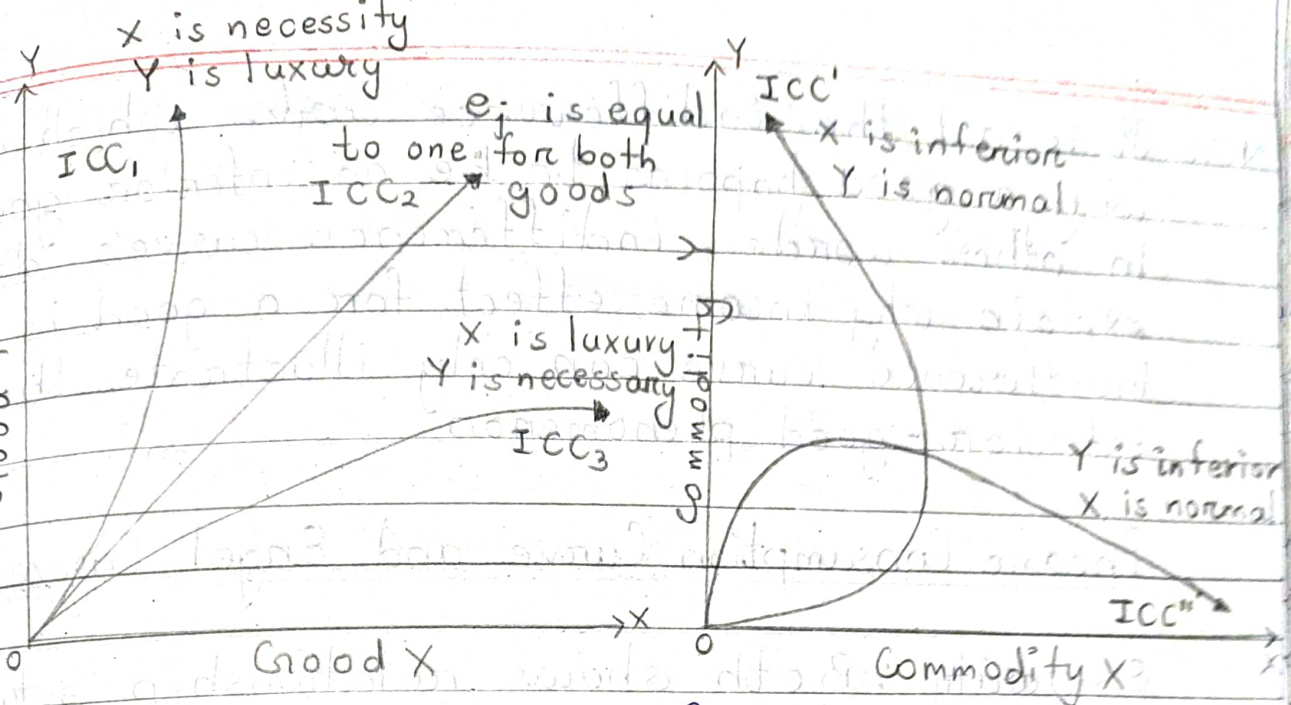


Income consumption curve in case of good Y being Inferior

When with the increase in his income, the consumer begins to consume superior goods, the consumption by him of inferior goods falls.

It would be noticed from these two figures that income effect becomes negative only after a point. It signifies that only at higher ranges of income, some goods become inferior goods and up to a point their consumption behaves like those of normal goods.

This is because when the people are poor, they cannot afford to buy the superior goods.



Income consumption curves of Normal goods

Income consumption curves of Inferior goods

Normal good can either be necessities or luxuries.

necessity : If the quantity purchased of a commodity rises less than proportionately to the increase in ~~income~~ income.

luxury : If the quantity purchased of a commodity increases more than proportionately to the increase in income.

~~In~~ ICC2 is a linear curve passing through the origin which implies that increase in the quantities purchased of both the goods are rising in propertion to the increase in income Therefore neither good is luxury or necessity.

If income effect for good X is negative, income consumption curve will slope backward to the left as ICC' and if good Y happens to be an inferior good and income consumption curve will bend towards X-axis as shown by ICC".

NOTE It is not the indifference curve which explains why a good happens to be an inferior good. In other words, indifference curves do not explain why income effect for a good is negative. Indifference curve can only illustrate the inferior-good phenomenon.

Income Consumption Curve and Engel Curve

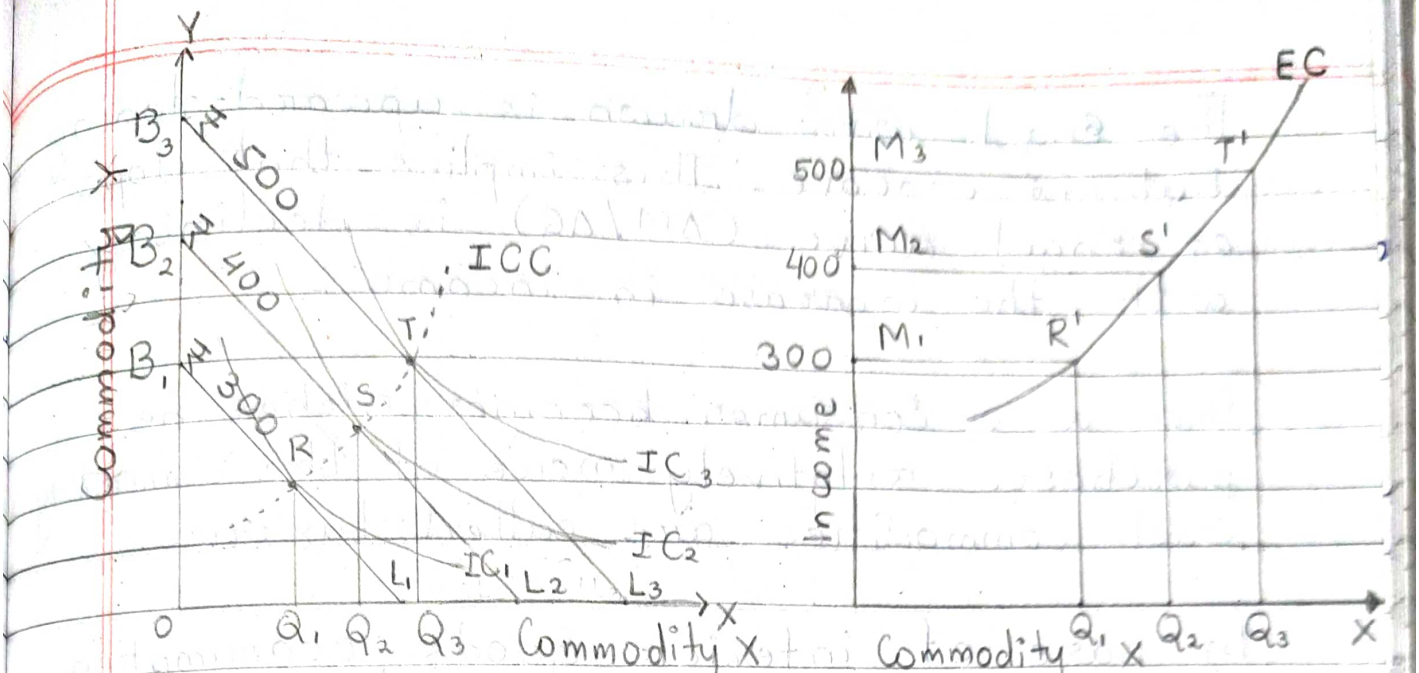
Similarity : Both shows relationship between the level of consumer's income and the quantity purchased of commodity.

difference :
ICC : graph plotted for two commodity
Engel curve : graph plotted for one commodity

According to Engel's studies, as the income of a family increases, the proportion of its income spent on necessities such as food falls and that spent on luxuries increases. This change in the pattern of consumption expenditure with the rise in income of the families has been called **Engel's law.**

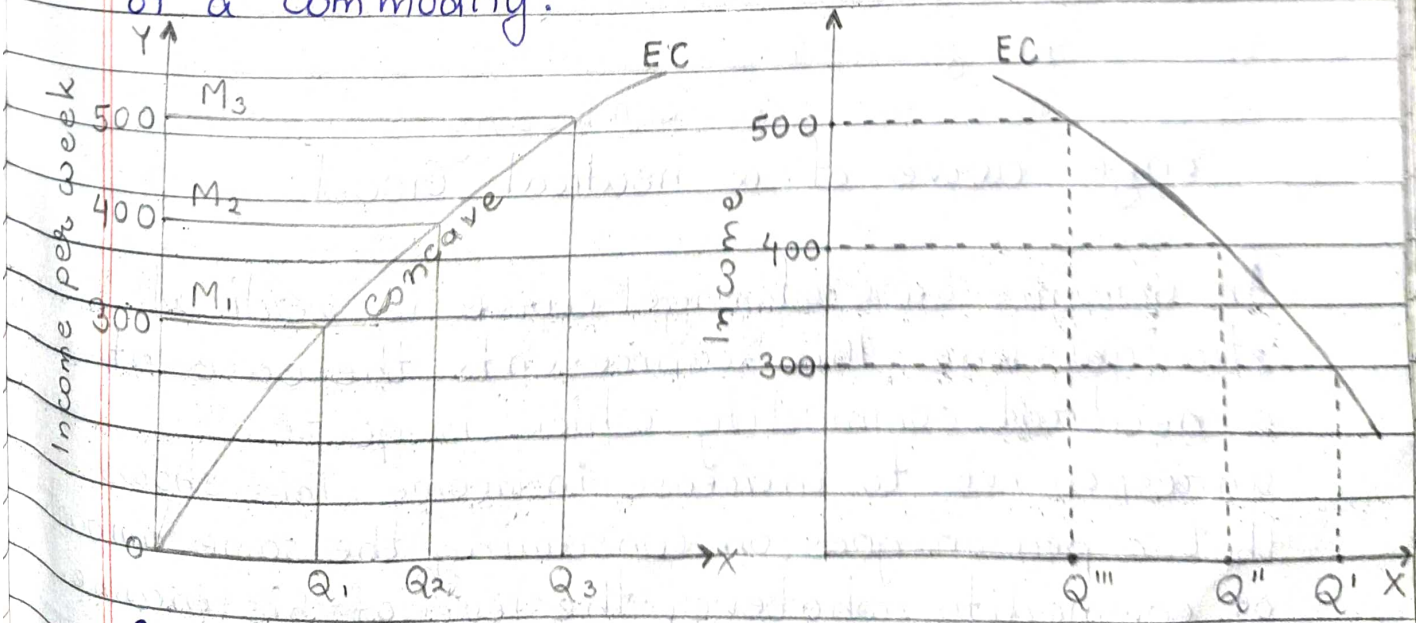
The curve showing the relationship between the levels of income and quantity purchased of particular commodity is called **Engel Curve.**

NOTE Engel curve for normal goods are upward sloping



(Engel curve for normal goods are upward sloping)
Deriving Engel curve from Income consumption curve in case of necessities.

The slope of Engel curve EC in the above graph equals to $\Delta M/\Delta Q$ where ΔM stands for change in income and ΔQ for change in quantity demanded, and has a +ve (positive) sign. This shows that engel curve EC for normal goods is upward-sloping which means that as income increases, consumer buys more of a commodity.



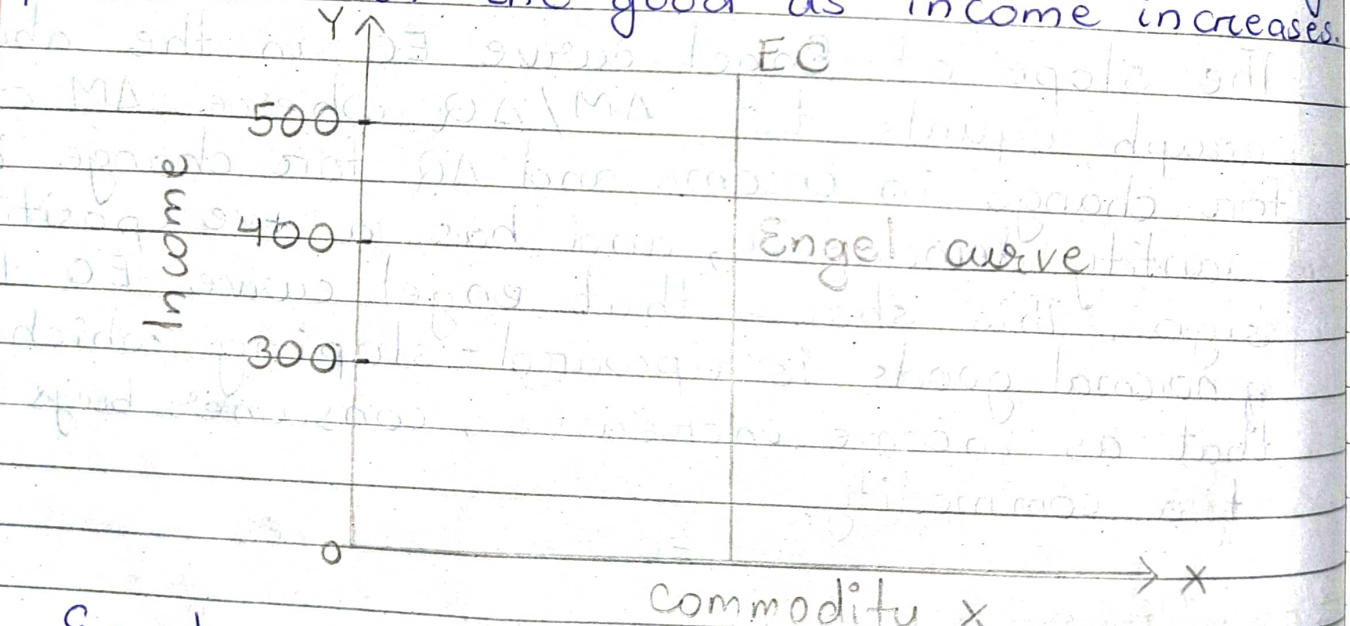
Engel curve of a Luxury

Backward bending Engel curve of an inferior Good

The Engel curve drawn is upward-sloping but is concave. This implies that slope of Engel curve ($\Delta M / \Delta Q$) is declining with the increase in income.

Thus as a consumer becomes richer he purchases relatively more of the commodity. Such commodities are called luxuries.

In case of inferior goods, consumption of commodity declines as income increases. Engel curve of inferior good is backward bending indicating a fall in the quantity purchased of the good as income increases.



Engel curve of a neutral Good

An extreme case of engel curve is vertical straight line. This represents the case of a neutral commodity which is quite unresponsive to increase in income. This shows that a person goes on consuming the same amount of commodity whatever the level of his income. For example: common salt

Substitution Effect

Substitution effect is another factor which is responsible for the changes in consumption of a good. It is always negative.

defination :

Substitution effect means the change in the quantity purchased of a good as a consequence of a change in its relative price alone, real income or level of satisfaction remaining constant.

Two slightly different concept of substitution effect have been developed :

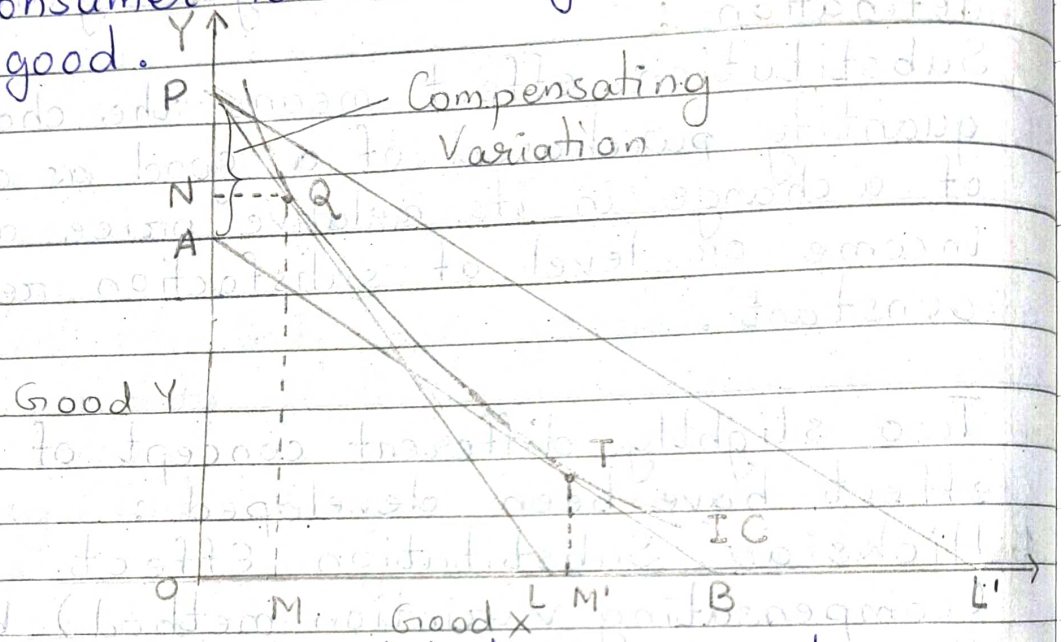
1. Hicksian Substitution Effect (compensating variation method) by J. R. Hicks & R. G. D. Allen
2. Slutsky substitution Effect (cost difference method) by E. Slutsky

The two method differ in regard to the magnitude of the change in money income which should be effected so as to neutralise the change in real income of the consumer which results from a change in price.

Hicksian Substitution effect (compensating variation method)

The amount by which the money income of the consumer is changed so that the consumer is neither better off nor worse off than before is called compensating variation in income.

Thus compensating variation in ~~con~~ income is a change in the income of the consumer which is just sufficient to compensate the consumer for a change in the price of a good.



Hicksian Substitution Effect

It is thus clear that a fall in relative price of a commodity always leads to the increase in its quantity demanded due to the substitution effect, the consumer's satisfaction or indifference curve remaining the same. Thus the substitution effect is always negative. The negative substitution effect implies that the relative price of a commodity and its quantity demanded change in opposite direction, that is, the decline in relative price of a commodity always causes increase in its quantity demanded.

Breaking up price effect

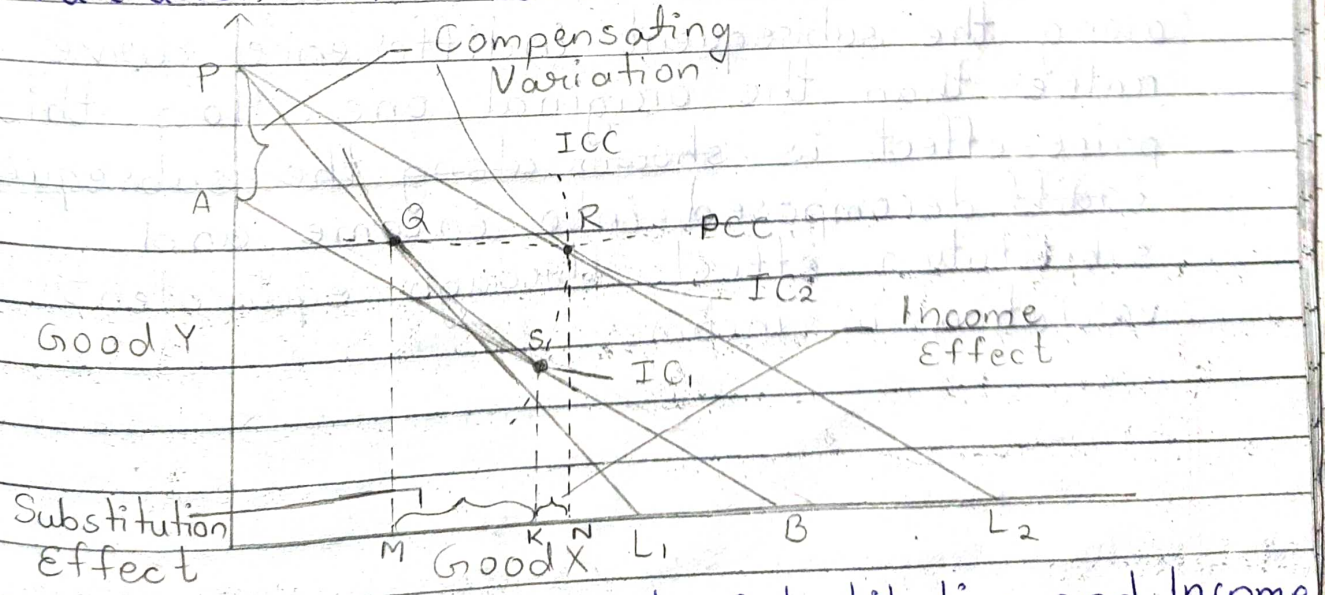
Price effect = Income effect + Substitution effect

Hicksian method:

i) Compensating variation in income
ii) Equivalent variation in income

i) Compensating variation in income

When the price of a commodity falls and consumer moves to a new equilibrium position at a higher indifference curve his satisfaction increases. To offset this gain in satisfaction resulting from a fall in price of the good we must take away from the consumer enough income to force him to come back to his original indifference curve. This required reduction in income to cancel out the gain in satisfaction or welfare ~~occured~~ occurred by reduction in price of a good is called compensating variation in income.



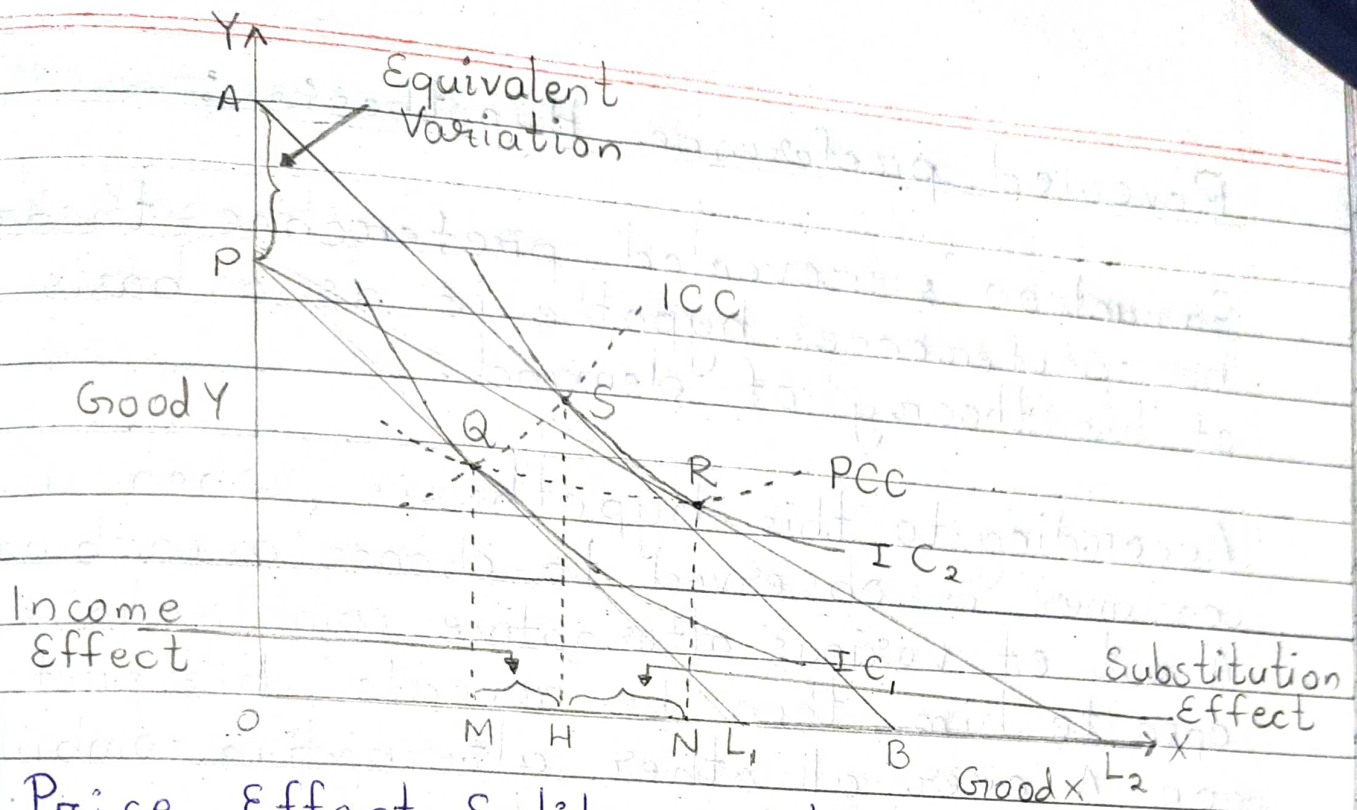
Price Effect split up into Substitution and Income Effects through Compensating Variation method

Price effect = MN
Substitution effect = MK
Income effect = KN
MN = MK + KN
Price effect = substitution effect + Income effect

∴ Compensating variation = AP

ii) Equivalent Variation method :
The increase in income of the consumer, prices of goods remaining the same, so as to enable him to move to a higher subsequent indifference curve at which he in fact reaches with reduction in price of a good is called equivalent variation in income because it represents the variation in income that is equivalent in terms of gain in satisfaction to a reduction in price of the good.

Thus in this equivalent income-variation method substitution effect is shown along the subsequent indifference curve rather than the original one. How this price effect is ~~shown~~ along the ~~subsequent~~ ~~indiff~~ decomposed into income and substitution effects through equivalent variation in income.



Price Effect Split up into income and Substitution Effects through Equivalent Variation method

Price effect = MN
Income effect = MH
Substitution effect = HN
MN = MH + HN
Price effect = Income Effect + Substitution effect

Price effect : Price consumption Curve (PCC)

- Price effect shows the effect of change in price on quantity purchased of the good.
- PCC traces out the price effect.
- PCC is the locus of the different equilibrium points which represents different quantity demanded with respect to different prices.
- PCC shows how the changes in price of a commodity will affect the consumer's purchase of the commodity

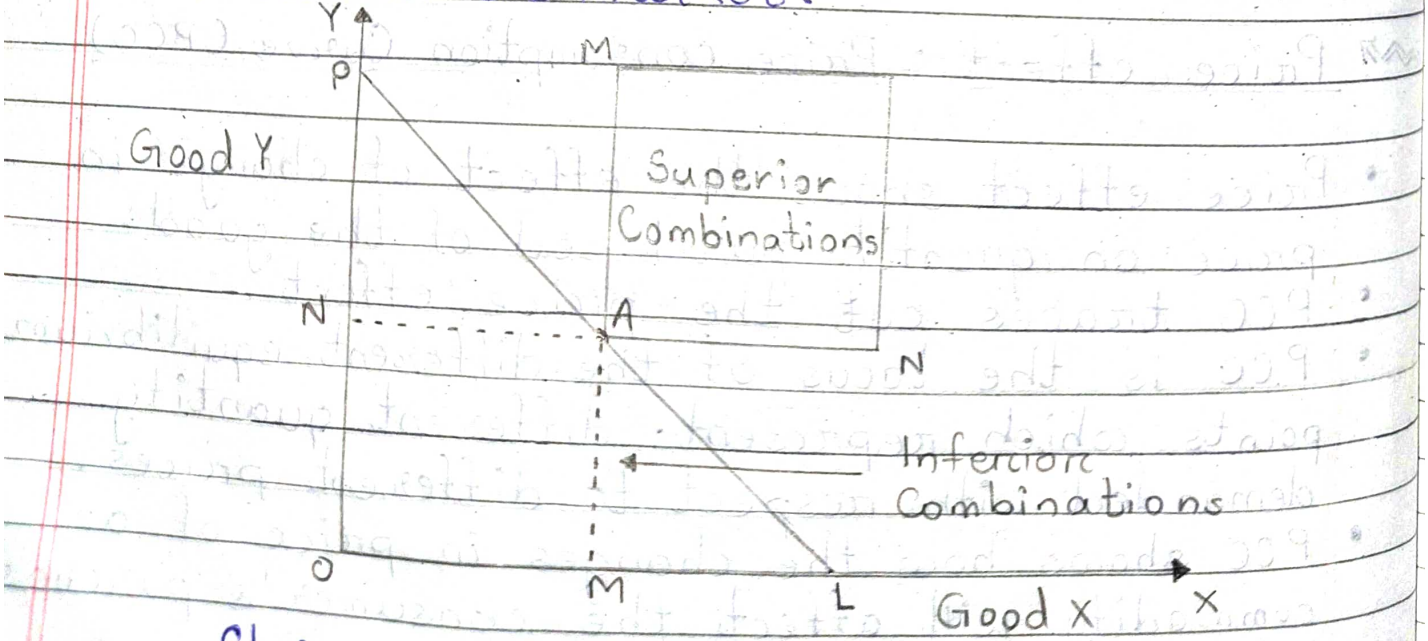
Revealed preference Hypothesis :

Samuelson's revealed preference theory has preference hypothesis as a basis of his theory of demand.

According to this hypothesis, when a consumer is observed to choose a combination A out of various alternative combinations open to him, then he 'reveals', his preference for A over all other alternative combinations which he could have purchased.

Choice of the combination A reveals his definite preference for A over all other rejected combinations.

Thus from this hypothesis of 'choice reveals preference' we can obtain definite information about the preference of a consumer from the observations of his behaviour in the market.



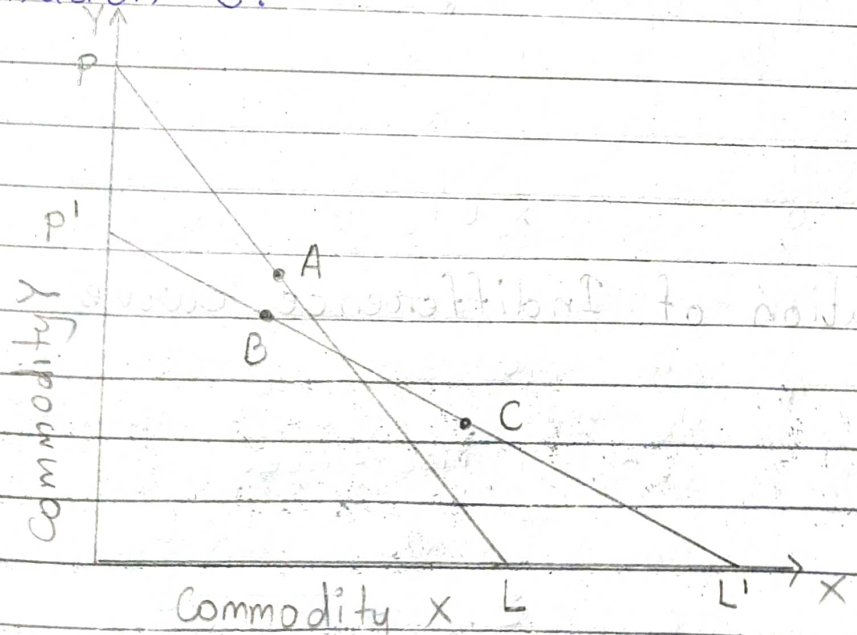
Choice reveals preference

Assumptions :

✓ **Rationality** : Consumer behaves rationally, which means he prefers bundles of goods that includes more quantities of the commodity.

✓ **Consistency** : The consumer's choice is consistent over time. It means if he chooses Bundle - A in a situation in which Bundle - B was also available to him, he will not choose B in any other situation in which Bundle - A is available.

✓ **Transitivity** : If in any situation Bundle - A is preferred over Bundle - B and Bundle - B is preferred over Bundle - C, then Bundle - A is preferred over Bundle - C.
In this way we say that combination A is indirectly revealed to be preferred to combination C.



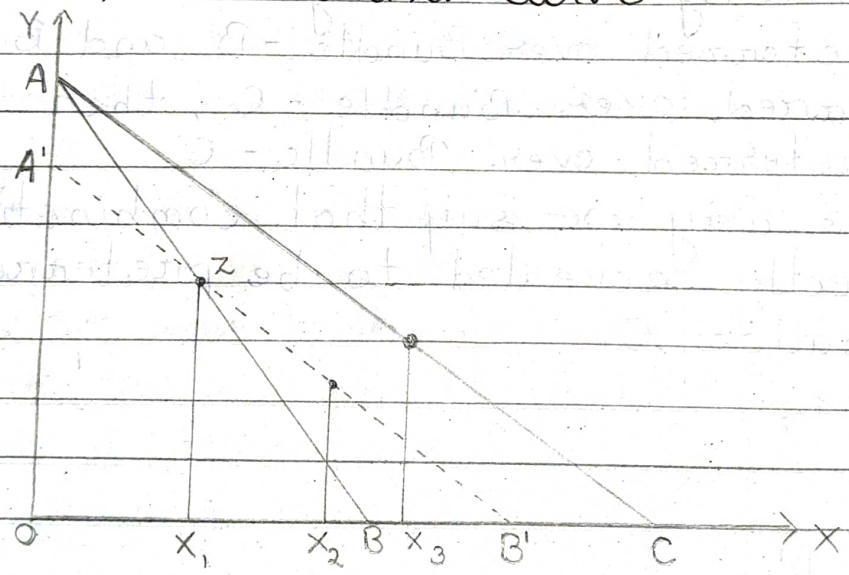
Revealed preferences are transitive

Thus combination A is indirectly revealed

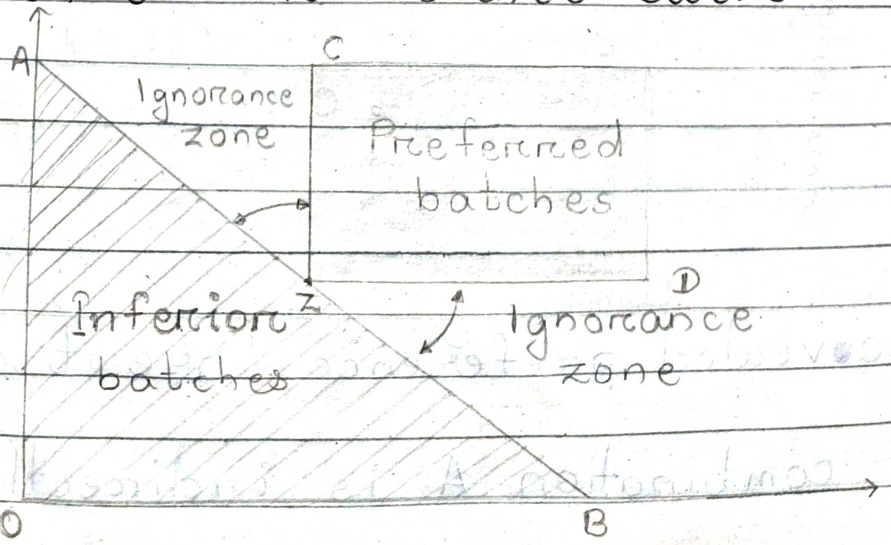
to be preferred to combination C. We therefore conclude that the consumer prefers A either directly or indirectly to all those combinations of two goods lying in the shaded regions.

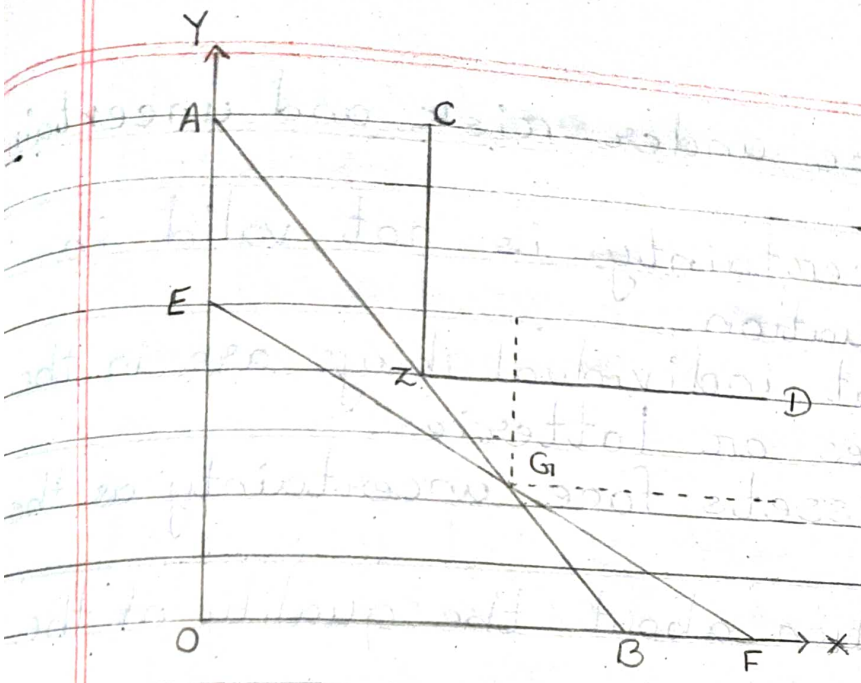
✓ Revealed Preference Axiom:
The consumer by choosing a bundle in any one budget situation, reveals his preference for that particular bundle. The selected bundle preferred among all other and maximises utility of the consumer.

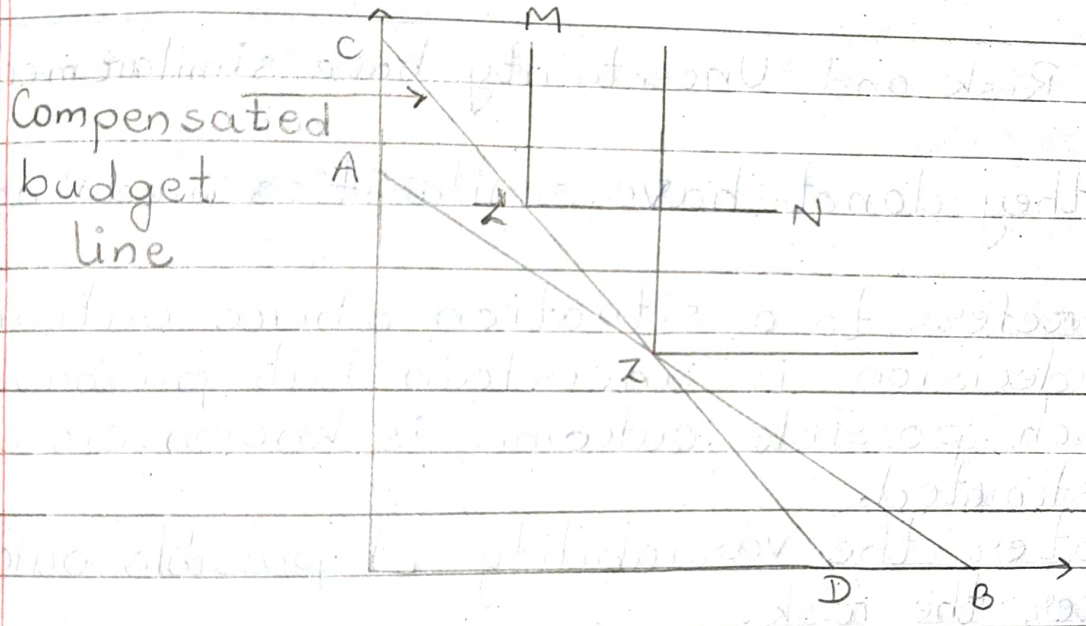
Derivation of Demand Curve



Derivation of Indifference curve







Consuming in MZ'N will give satisfaction along any one point

Synchronise upper ignorance zone

$MZ'N > Z'$

$Z' > Z$

$\therefore MZ'N > Z$ (according to transitivity)

Individual Choice under risk and uncertainty

Assumption of certainty is not valid in real world situation

↳ Some goods that individual buys are in the nature of games or lotteries.

↳ Investment in assets face uncertainty as the outcome.

↳ Lack of information about the quality of the good.

Does Risk and Uncertainty have similar meaning?

No, they donot have similar~~ities~~ meaning.

Risk

Risk refers to a situation where outcome of a decision is uncertain but probability of each possible outcome is known or can be estimated.

Greater the variability of possible outcome greater the risk.

Uncertainty

It refers to the situation when there is more than one possible outcome but probability of occurrence of each particular outcome is not known or even cannot be estimated. This may be due to lack of sufficient past information or the great instability of the variables that determine the outcome.

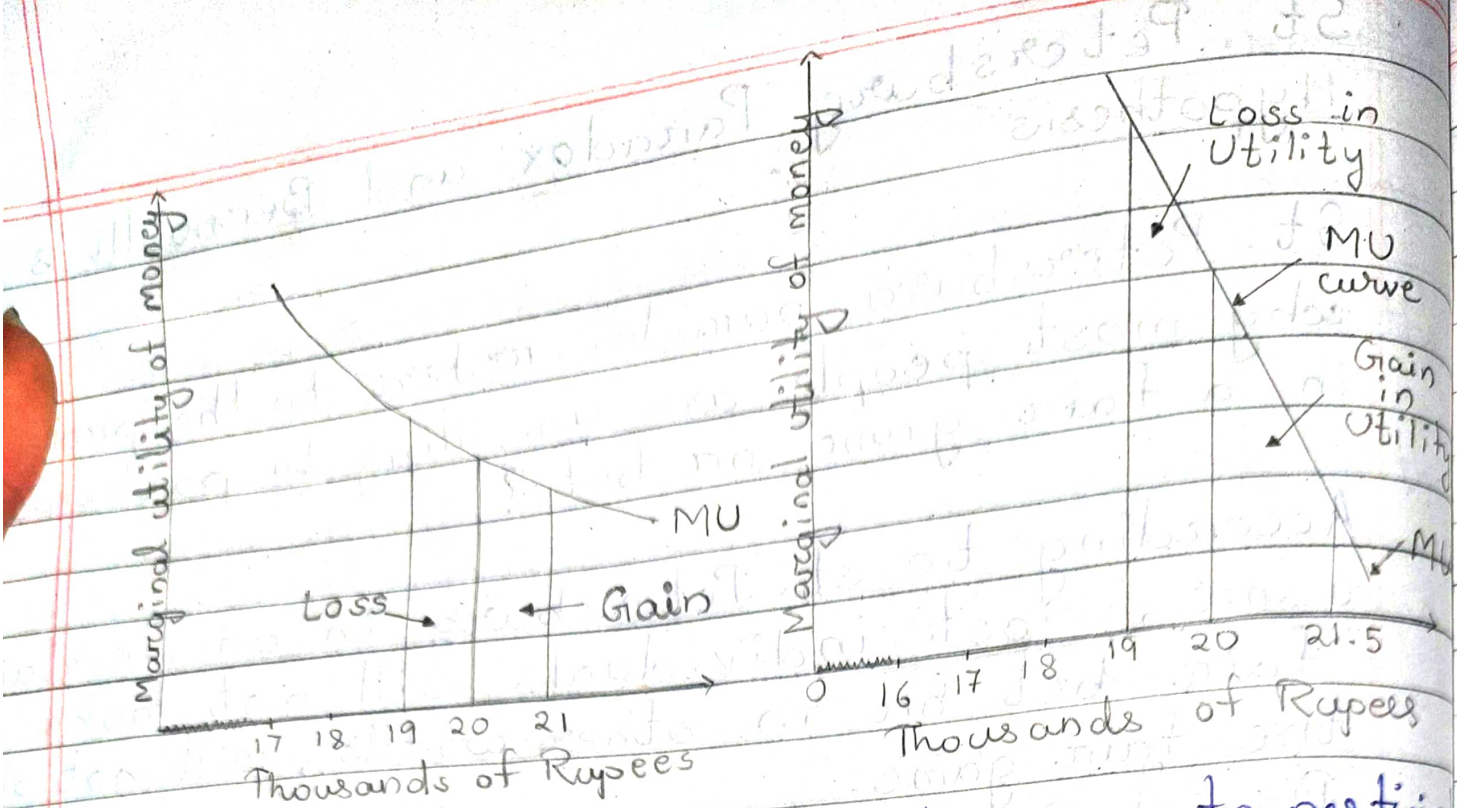
Though the distinction between risk and uncertainty is theoretically significant the two terms will be here used with same meaning

St. Petersburg Paradox and Bernoulli's Hypothesis

St. Petersburg paradox refers to the problem why most people are unwilling to participate in a fair game or bet?

According to st. Petersburg in an uncertain game, most individuals will not make a fair bet or in other words, will not play the fair game.
Daniel Bernoulli provided a convincing explanation of the said behaviour of rationd individual.
According to him, a rational individual will take decisions under risky and uncertain situations on the basis of expected utility rather than expected monetary value. He further contended that marginal utility of money to individual decline as he has more of it. Since the individual behaves on the basis of expected utility from the extra money if he wins a game, most individual will not play the game i.e will not make a bet. It is in this way that Bernoulli resolved St. Petersburg paradox.

In the diminishing marginal utility of money the expected gain in ~~us~~ utility is less than the expected loss of utility from one thousand rupees involved in the bet, a rational individual will therefore not make a bet with 50-50 odds.



Bernoulli's hypothesis: unwillingness to participate in a fair game

Unwillingness to participate at favorable when MU of money declines rapidly.

Utility Theory and attitude towards Risk

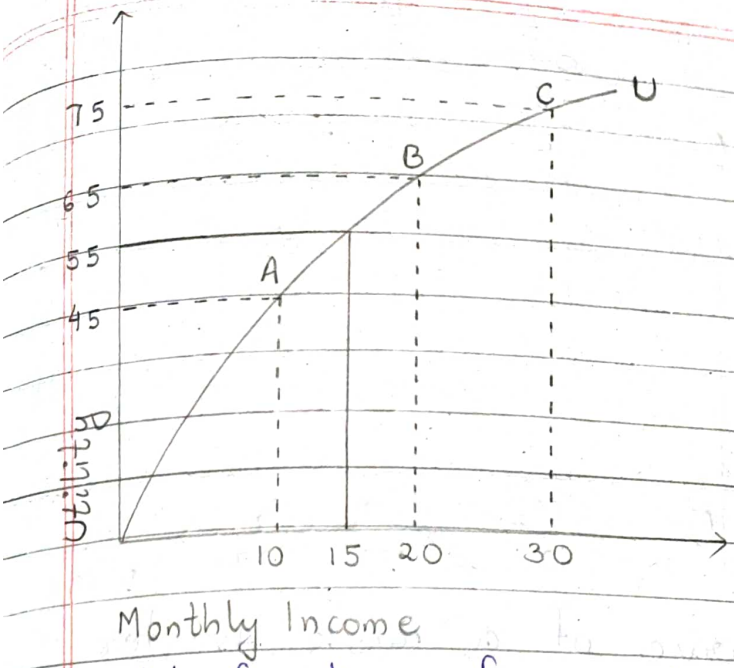
Risk Averse : A person who prefers a certain given income to a risky job with the same expected income is called risk averse.

Risk Lovers : A person who ~~ref~~prefers a risky outcome with the same expected income as a certain income.

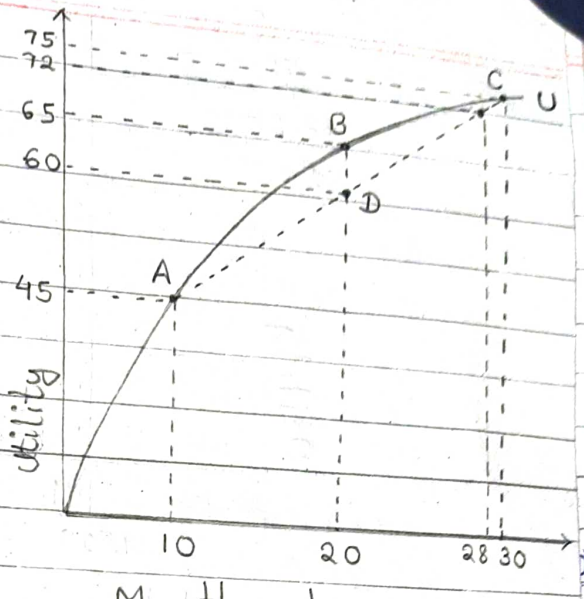
Risk Neutral : A person who is indifferent between a certain given income and an uncertain income with the same expected values.

Expected income/amount
= winning amount x probability + losing amount x probability

$$E(Y) = W \cdot P(W) + L \cdot P(L)$$

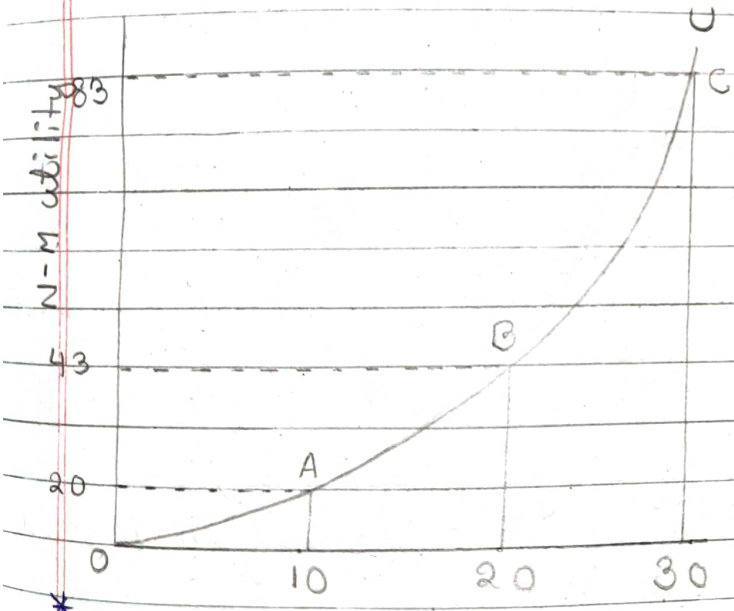


Utility function of a risk Averter

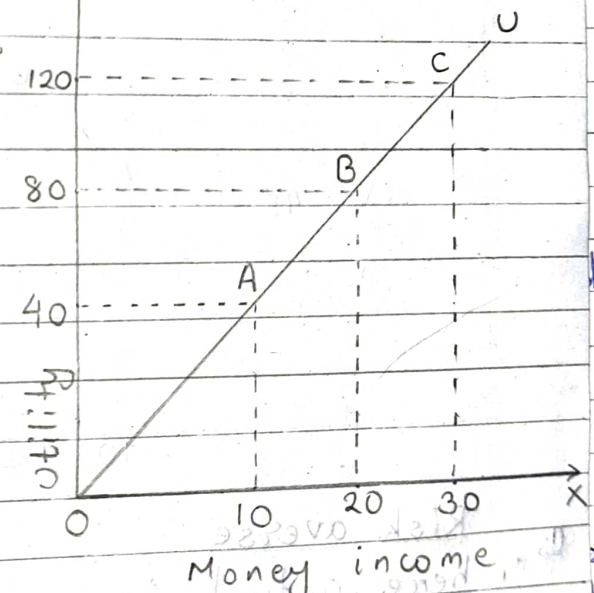


Choice of a risk averse individual

*1



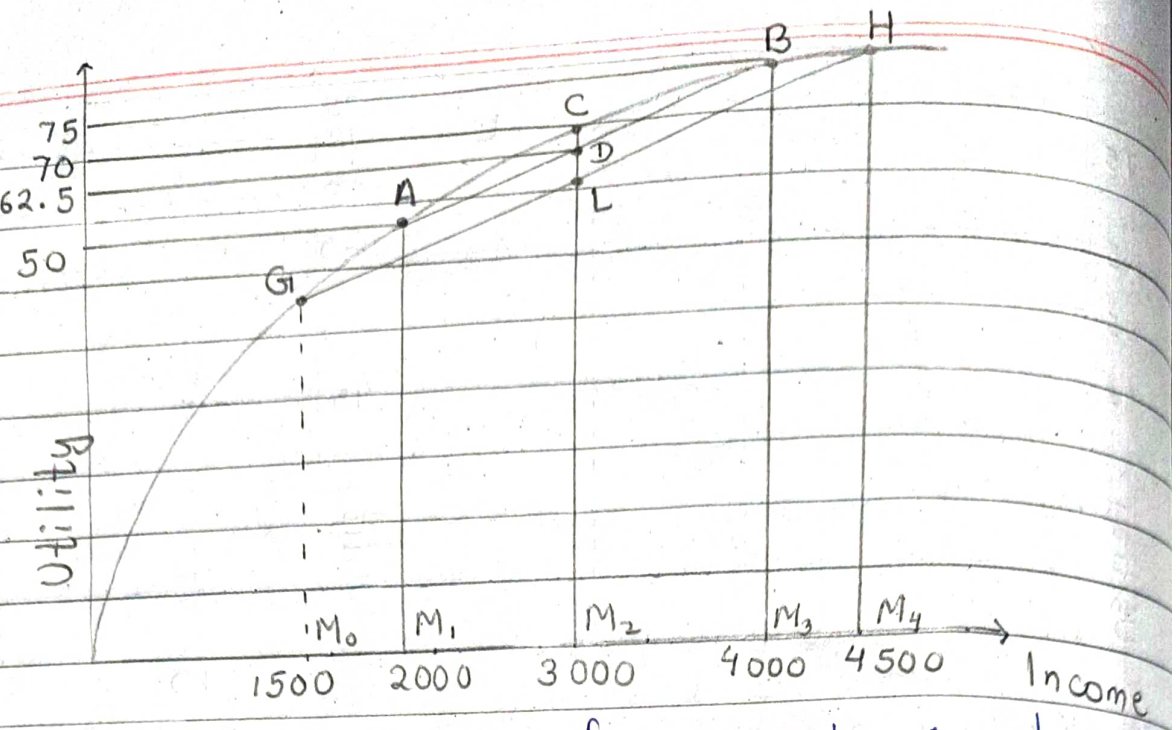
*2 Utility function of a risk lover



Utility function of a ~~re~~ risk neutral

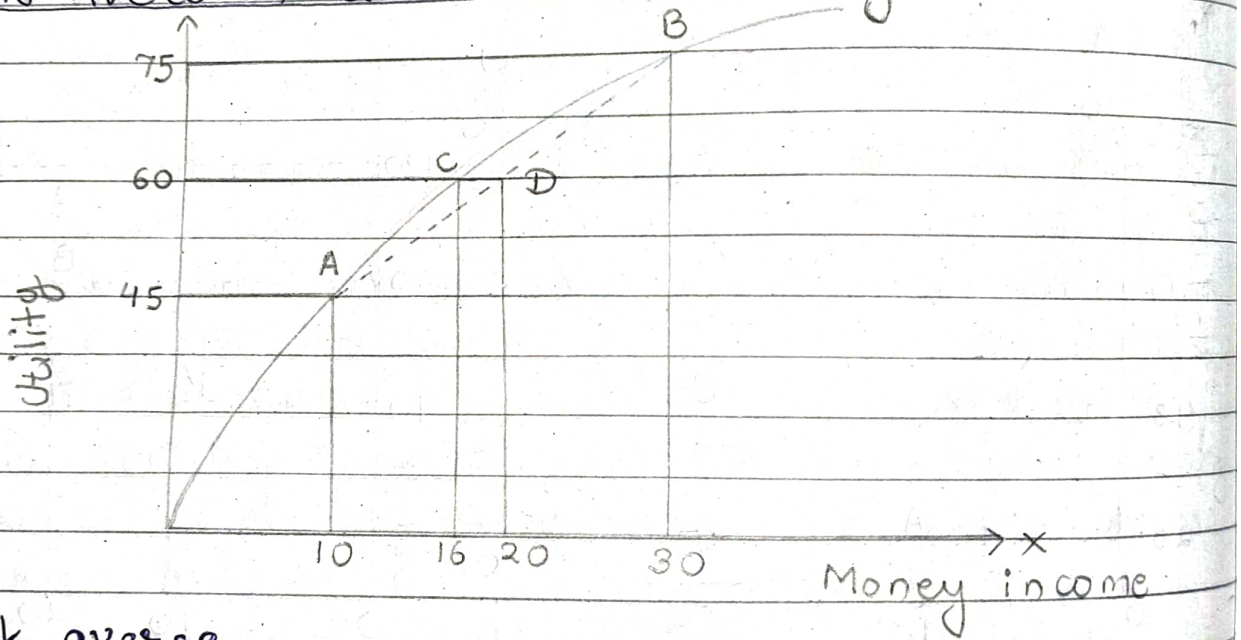
Risk Aversion and Fair Bets

The person who refuses a fair bet is said to be risk averse. Thus, the risk averter is one who prefers a given income with certainty to a risky gamble with the same expected value of income.



Concave utility curve of a risk Averter

Risk Aversion and Insurance



Risk averse

↳ *. here actual income = 20k

expected income = $30 \times 0.5 + 10 \times 0.5$

= 20k

Now, actual income = expected income

expected utility = $75 \times 0.5 + 45 \times 0.5$

= 65

here, on an average the person is losing in terms of utility.

Thus, in risk aversion, utility curve must be concave to x-axis.
Because, here slope is decreasing thus MU is decreasing and so the person will not move towards the risk region.

*2 Risk lover

expected utility = (83 × 0.5) + (20 × 0.5)
= 51.5

expected income = 0.5 (10,000) + 0.5 × (30,000)
= 5000 + 15000
= 20 K

• since, the expected utility > actual utility
Thus, risk lover individual will prefer the new risky job even though the expected income is same as present.

Neumann - Morgenstern (N-M) Utility Index

- N-M provided a method to measure expected utility from win and prizes using cardinal measure.
- They assign a utility number considering stock of money.
- The choice by an individual under risky and uncertain situation depends on the N-M utility index.

Assumptions:

- Individual possesses a scale of preferences that is quite comprehensive and complete
- Individual can always say whether he prefers one event to another or he is indifferent the two

- Individual's choices are consistent.

Construction of N-M utility Index:

- State the numerical probabilities of uncertain events of acquiring additional money
- Finding expected monetary value of the risky event

Expected monetary value of risky event

$$[P(W) \times U(W)] + [P(L) \times U(L)]$$

- Assign utility number arbitrarily
- The objective here is to evaluate the utility of certain sum of money (certainty equivalent)
- Certainty equivalent is the sure sum of money.
- The individual is indifferent between certainty equivalent and the probable amount of money with a certain probability in an uncertain and risky situation
- Certainty equivalent can be identified by interrogating the individual
- Now taking different probability and different amount the price can be calculated.

Example

- Lottery ticket

$W = ₹ 5000$, $P(W) = 0.6$

$L = ₹ 10$ (consolation Prize), $P(L) = 1 - 0.6 = 0.4$

Expected monetary value of lottery ticket

$= W P(W) + L P(L)$

$= 5000 \times 0.6 + 10 \times 0.4$

$= 3000 + 4$

$= ₹ 3004$

But N-M wish to measure expected utility from monetary gain rather than expected value of monetary gain

Expected utility of lottery ticket
$= P(W) \times U(W) + P(L) \times U(L)$
$= 0.6 \times U(5000) + 0.4 \times U(10)$

Now, assign utility number arbitrarily
Lets assume 1 utils = ₹10
so,
$= 0.6 \times 500$ utils $+ 0.4 \times 1$ utils
$= 300$ utils $+ 0.4$ utils
$= 300.4$ utils
But, the objective of N-M method is to evaluate the utility of a certain sum of money. To do this the "certainty Equivalent" tool is used.

- A "Certainty Equivalent" is the sure sum of money.
- An individual is indifferent between a certain sum of money and the probable amount of money with risk situation.

Suppose, "Certainty Equivalent" = ₹3000
Utility of ₹3000 = Expected utility of ticket
So, ₹3000 = 300.4 utils.

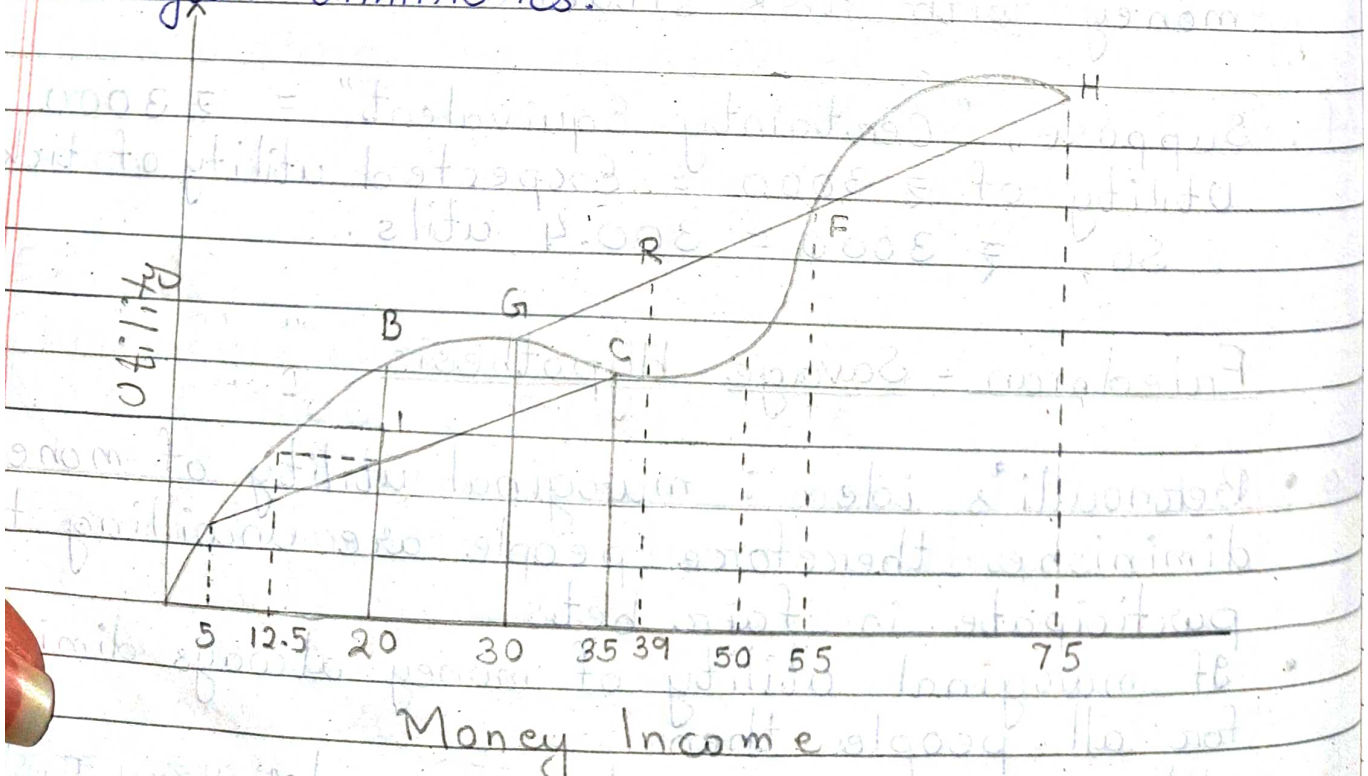
Friedman - Savage Hypothesis

- Bernoulli's idea: marginal utility of money diminishes therefore people are unwilling to participate in fair bets
- If marginal utility of money always diminishes for all people then
- Why people make choices under very risky situations?

- Why people involves with gambling?
- Are those people irrational or thoughtless?

- As we have discussed N-M provided the method of measuring marginal utility of money nemerically.
- Based on idea of N-M, Friedman and savage put forward a hypothesis which explains, why the same person engage in gambling and at same time buy insurance.
- Friedman and savage abandoned the Bernoullian hypothesis of diminishing marginal utility of money for all ranges of income.

The Friedman-savage hypothesis states that, marginal utility of money income diminishes up to a certain income ~~and~~ ~~ther~~ after that it increases up to a level of income and thereafter at a very high level of income it again diminishes.



- Marginal utility of money income is different for a person at different levels of income.
- Subject to different level of income attitude towards risk changes.
- The utility curve indicates behaviour or attitude of people towards risk in different socio-economic groups.