

UNIT -3

Theory Consumer's Behavior

- a. Concept of Cardinal and Ordinal utility analysis
- b. Cardinal utility analysis : Assumptions, Consumer Equilibrium, criticism and derivation of demand curve
- c. Ordinal Utility Analysis: Concept, Properties of indifference curve, marginal rate of substitution, Price line and consumer equilibrium, Price effect: Derivation of PCC, Income effect: Derivation of ICC, Substitution effect, Decomposition of price effect into income effect and substitution effect, derivation of demand curve (Hicksian Approach), (Numerical exercise)

Theory Consumer's Behaviour

- Under the theory of consumer behaviour, we will study on how a consumer decides on purchasing goods and services with given price and limited budget to get maximum satisfaction.
- This unit tries to focus on “ How does the consumer's respond to change in price of the commodity, give his/her income?”
- First part focus on Cardinal utility analysis, which was started by the classical economists of late eighteen century and nineteenth centuries but matured at the hand of twentieth century with Alfred Marshall, A.C. Pigu, D.H. Robertson.

Concept of Cardinal and Ordinal Utility Analysis

- Utility is defined as want satisfying power of a commodity. It refers to the satisfaction obtained from the consumption of a commodity.
- Thus, utility denotes satisfaction. More precisely, it refers to how consumers rank different goods and services.
- Utility is a subjective concept. So, it varies with person to person, place to place and time to time.
- **Different consumers get different level of satisfaction from the same goods under same situation.**
- There are two approaches of utility analysis. They are - cardinal and ordinal approaches.

Cardinal Utility Analysis (Marshallian Utility Analysis)

The concept of cardinal utility was first developed by **H.H. Gossen** and further developed by **Alfred Marshall**. So, it is also called Marshallian Utility Analysis. The cardinalists defined that utility can be measured in terms of cardinal number. According to this concept utility (satisfaction) derived from the consumption of a commodity is measurable and can be express in quantitative terms. Cardinal utility analysis is based on the following assumptions.

1. **Rationality:** Cardinal utility analysis assumed that the consumer is rational in the sense that he/she tries to maximize his/her satisfaction by using goods and services subject to the budget constraints.
2. **Cardinal Measurement:** The utility is a cardinal concept. Utility of each commodity is measurable. It can be measured on the basis of measuring rod of money.
3. **Constant Marginal Utility of Money:** According to cardinal utility analysis, the marginal utility of money remains constant.
4. **Diminishing Marginal Utility:** The cardinal utility analysis assumed that the utility obtained from successive units of a commodity consumed decreases as a consumer consumes more and more units of it.
5. **Additive Utility:** It is assumed that utility is additive. If there are n commodities in the bundle consumed by a consumer with quantities x_1, x_2, \dots, x_n , then total utility can be written as: $U = f(X_1, X_2, \dots, X_n)$ and total utility is expressed as;
$$U = U_1 X_1 + U_2 X_2 + \dots + U_n X_n.$$

Types of Utility

Total Utility (TU)

The total utility is the sum total of utilities obtain by the consumer from different units of a commodity. In other words, the total utility is the aggregate of marginal utilities.

Mathematically, it is expressed as follows:

$$\text{Or, } TU = MU_1 + MU_2 + \dots + MU_n$$
$$TU = \Sigma MU$$

Where, TU= Total utility, $MU_1 + MU_2 + \dots + MU_n$ =Marginal utility derived from 1 to n units of the commodity, ΣMU =summation of marginal utility.

Marginal Utility (MU)

The additional unit to total utility that a consumer would derive from one more unit of consumption of a commodity is defined as marginal utility. In other words, marginal utility is the ratio of the change in total utility with the change in units of consumption.

Mathematically, it is expressed as follows:

$$MU = \Delta TU / \Delta Q \dots \dots \dots (1)$$

$$MU_n = TU_n - TU_{n-1} \dots \dots \dots (2)$$

Where MU=Marginal Utility, ΔTU =Change in Total Utility, ΔQ = Change in Quantity of Consumption,

MU_n = Marginal utility derived from nth unit of commodity

TU_n = Total utility derived from the nth unit of the commodity.

TU_{n-1} = Total utility derived from the (n-1)th unit of the commodity

Relation between Total Utility and Marginal Utility

- Initially Total Utility(TU) curve is sloping upward after reaching maximum point, it starts to decline.
- Total Utility (TU) is increasing at decreasing rate initially.
- Marginal Utility(MU) is declining with in increasing consumption.
- Relations between TU and MU:
 - i) When Marginal Utility(MU) is declining (but positive) results, Total Utility(TU) is increasing at decreasing rate.
 - ii) When Marginal Utility(MU) is zero, Total Utility(TU) is maximum at that time.
 - iii) When Marginal Utility is negative, Total Utility (TU) is also declining

Law of Diminishing Marginal Utility

According to The law of diminishing marginal utility, as a consumer consumes more units of a goods, the extra utility or satisfaction that s/he derives from an extra unit of the goods goes on falling. In other words, marginal utility of goods diminishes as an individual consumer consumes more units of goods.

According to **Marshall**, *“the additional benefit which a person derives from a given increase of his stock of a thing diminishes with every increase in the stock that he already has”*.

Assumptions:

This law is based on the following assumptions:

1. The consumer is rational.
2. Utility can be measured in cardinal number.
3. Marginal utility of money remains constant.
4. All the units of consumption are homogeneous.
5. No time gap between consumption.
6. No change in income, taste and preference of the consumer.

Law of Diminishing Utility :

Table shows as consumer increases consumption of commodity, total utility increases but marginal utility decreases with increase in consumption of commodity .

UNIT	Total Utility	Marginal Utility
1	20	
2	35	15
3	45	10
4	52	7
5	55	3

Consumer's Equilibrium under Law of Diminishing Marginal Utility (Single Commodity Case)

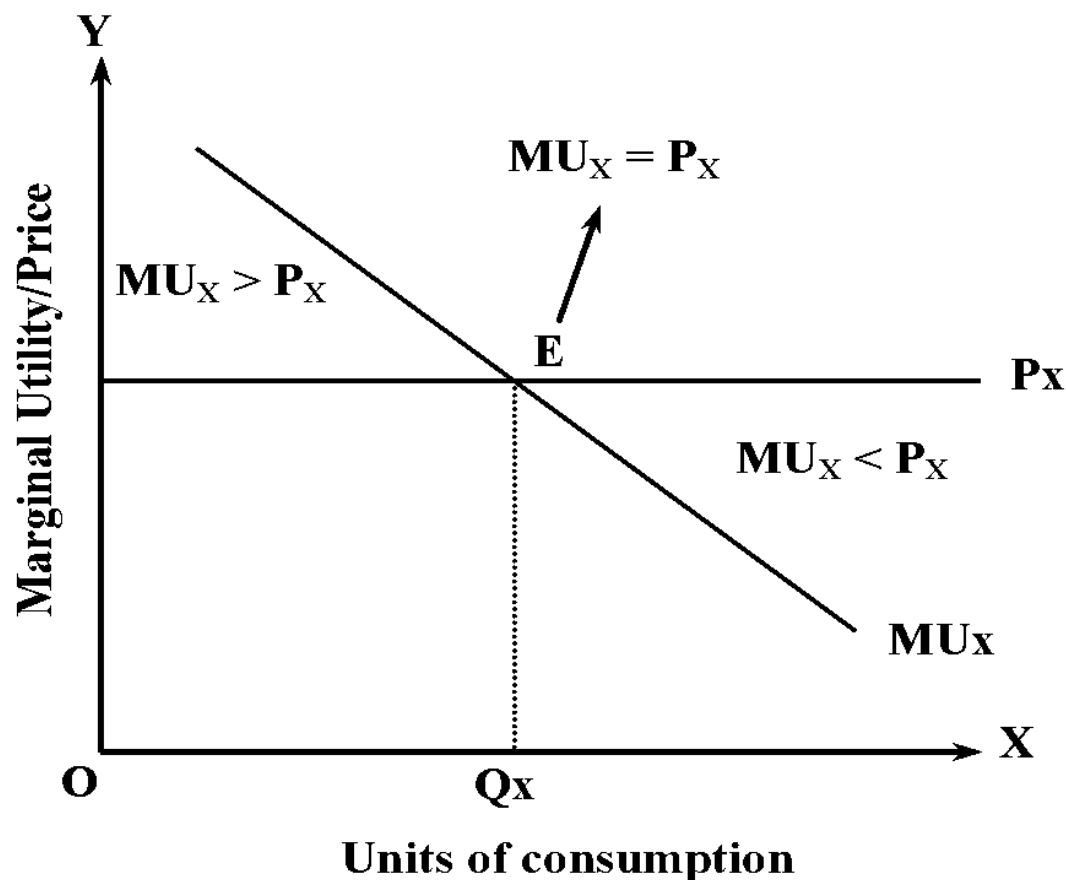
A consumer is said to be in equilibrium position when s/he maximizes his level of satisfaction, given his/her resources. In single commodity case, the consumer either buy x good or retain his/her money income.

Under these conditions, the consumer is in equilibrium when the marginal utility of x-commodity is equal to its market price (marginal utility of money).

$$\text{Thus, } MU_x = P_x(MUm)$$

Where, MU_x = Marginal Utility of commodity X
 P_x = Price of commodity X

Consumer's Equilibrium under Law of Diminishing Marginal Utility (Single Commodity Case)



Explanation of figure

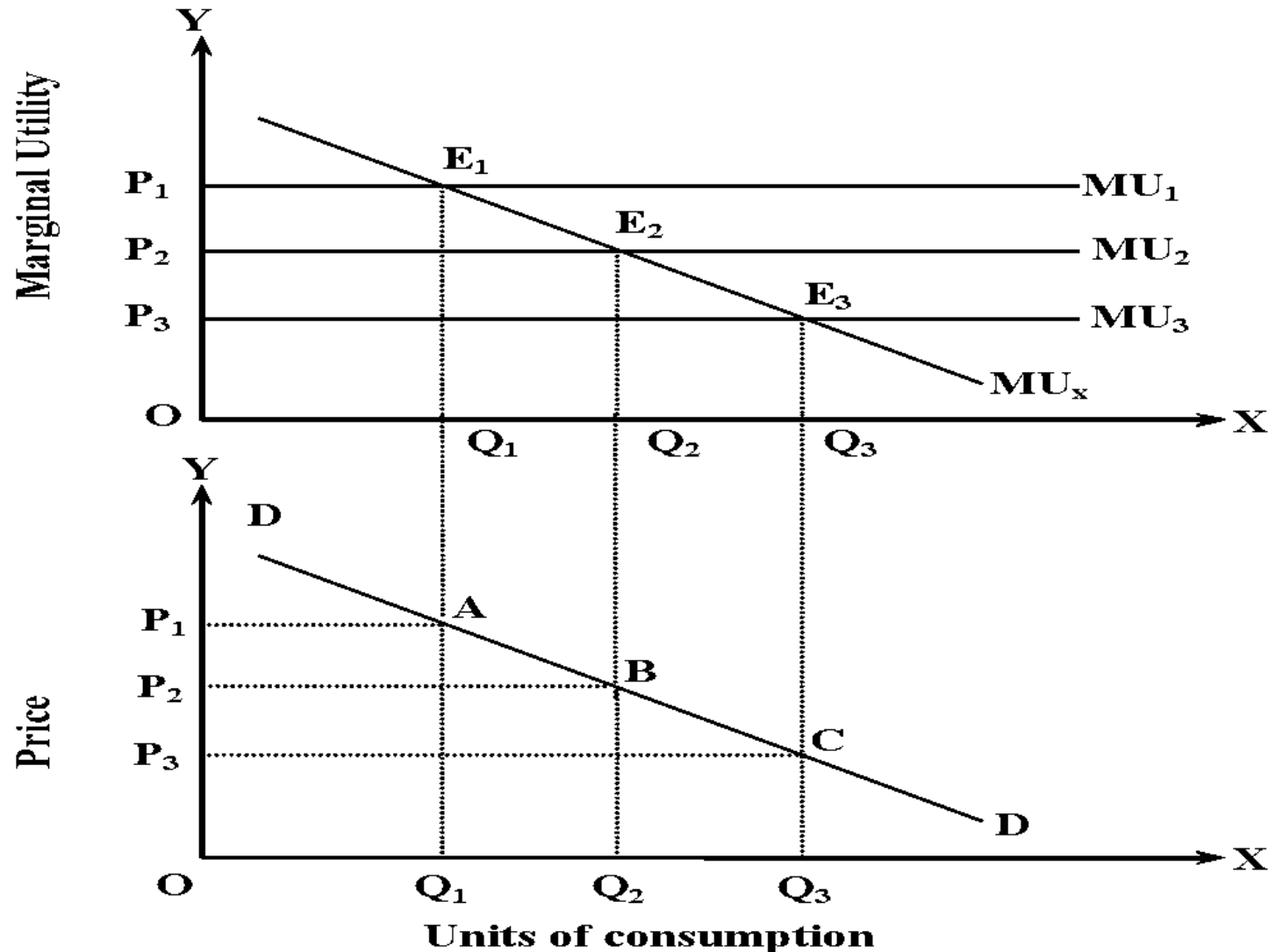
- P_x is the price line that shows the constant marginal utility of money.
- MU_x is the marginal utility curve of x-commodity that shows the downward sloping.
- The price line P_x and MU_x curve intersecting each other at point E, that means $P_x = MU_x$, thus, the consumer is equilibrium at E point where Q_x is equilibrium Quantity of consumer and P_x is equilibrium price.
- When $MU_x > P_x$, the consumer can increase utility /satisfaction by purchasing more unit of X-commodity.
- When $MU_x < P_x$, the consumer can increase utility/satisfaction by reducing purchase of X-commodity.

Derivation of Demand Curve from Law of Diminishing Marginal Utility

The derivation of demand is based on the axiom of diminishing marginal utility. The marginal utility curve of a good is downward sloping. Now, a consumer will go on purchasing a good until the marginal utility of a good equals the market price. The consumer's satisfaction will be maximum only when marginal utility equals price. Thus the marginal utility equals price is the condition of equilibrium where $MU_x = P_x$.

Demand curve of the commodity is also downward sloping that means when the price of the commodity falls, consumer will buy more of it to attained equilibrium.

Derivation of Demand Curve from Law of Diminishing Marginal Utility



Explanation of figure

- In upper part of the figure,
- MU_x curve shows the diminishing marginal utility of X.
- Initially consumer is in equilibrium at E_1 point where $MU_x = P_1(MU_m)$ and equilibrium Quantity is OQ_1 unit of X commodity.
- If price of commodity falls to P_2 and P_3 consumer will be equilibrium at E_2 and E_3 with equilibrium Quantities of OQ_2 and OQ_3 respectively.
- Lower part of the figure shows the relationship between price and quantity demanded of X commodity.
- When Price is P_1 , consumer purchases OQ_1 units of X-commodity which is indicated by A.
- Similarly when prices is falls to P_2 and P_3 , the quantity purchased increases by OQ_2 and OQ_3 which is denoted by point B and C respectively.
- After joining A, B and C point, we get Demand curve with downward sloping to the right.

Consumer's Equilibrium: Law of Equi-Marginal Utility

The law of equi-marginal utility is also called the law of substitution or the law of maximum satisfaction. The consumer will get maximum satisfaction only when he obtain equal marginal utilities from the consumption of different commodities.

If there are two goods X and Y the consumer's equilibrium is given as:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = MU_{\text{marginal}}$$

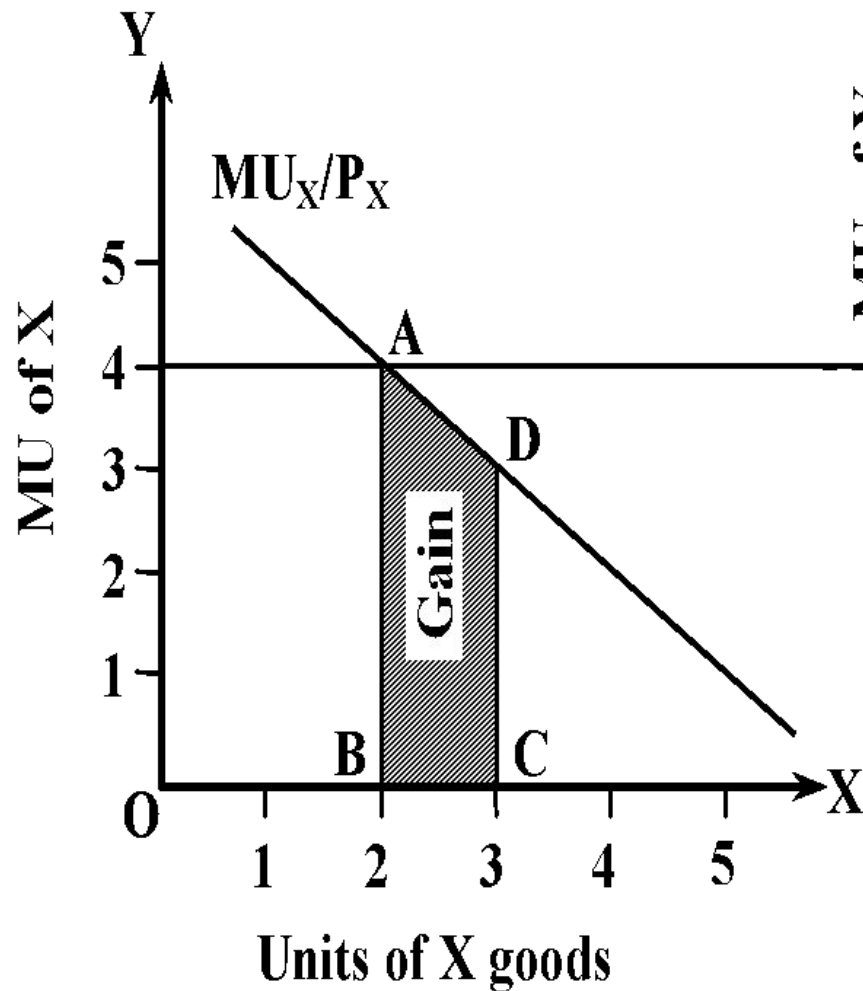
Suppose a consumer has a fixe budget: suppose s/he has Rs 18 and s/he has to choose at least two goods. Price of x and y have Rs 3 and Rs 2 per unit respectively, if consumer purchase only X good, total utility= $42+36+30+24+18+12=162$, if consumer purchase only Y good, total utility= $20+18+16+14+12+10+8+6+4=108$, if consumer purchase both X and Y good in such a way marginal utility from last unit is equal as 8, Total utility= $42+36+30+24+20+18+16=186$, which is maximum Total utility.

UNITS	MU _x (Utility)	MU _y (Utility)	MU _x /P _x	MU _y /P _y
1	42	20	14	10
2	36	18	12	9
3	30	16	10	8
4	24	14	8	7
5	18	12	6	6
6	12	10	4	5
7	6	8	2	4
8	3	6	1	3
9	0	4	0	2

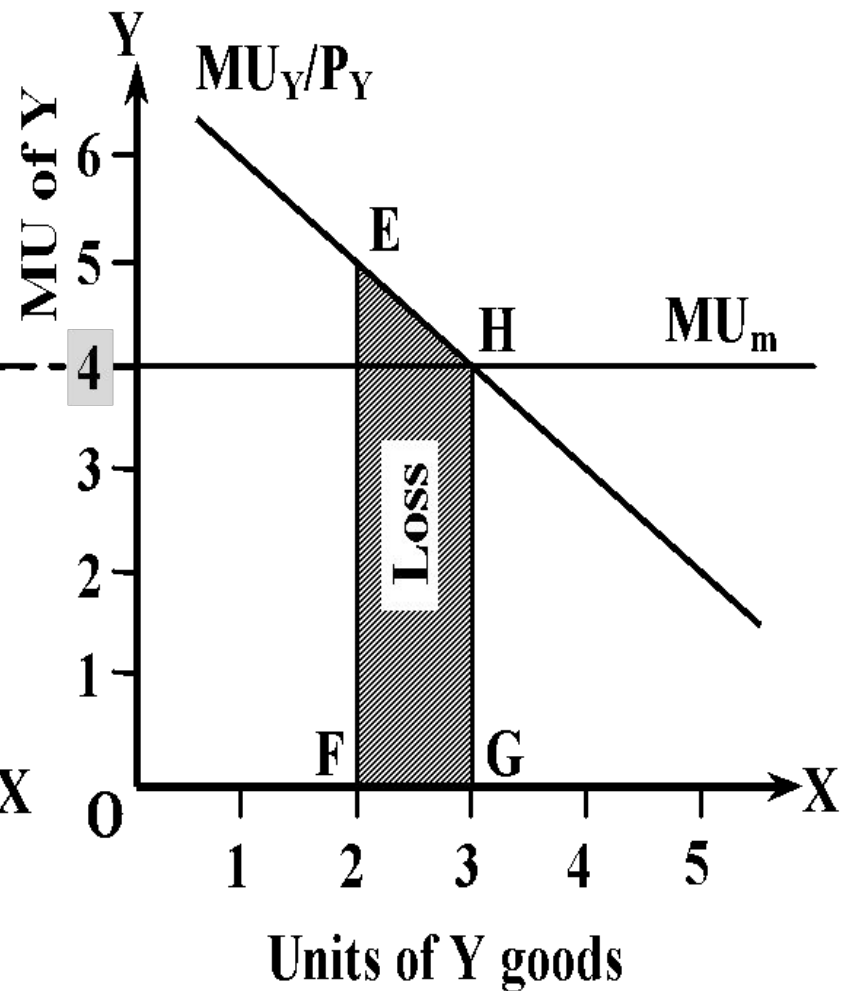
Suppose a consumer has a fixe budget: Suppose consumer has Rs. 10 as a budget and consumer has to choose at least two goods. Again let's price of x and y have Rs.2 and Rs. 2 per unit. If consumer purchase only X good total utility= $10+8+6+4+2=30$, if consumer purchase only Y good, total utility= $12+10+8+6+4=40$. If consumer purchase both X and Y good in such a way that marginal utility from last unit is equal as 4 by spending total budget, Total utility= $10+8+12+10+8=48$, which is maximum Total utility.

UNITS	MU _x (Utility)	MU _y (Utility)	MU _x /P _x	MU _y /P _y
1	10	12	5	6
2	8	10	4	5
3	6	8	3	4
4	4	6	2	3
5	2	4	1	2
6	1	3	0.5	1.5
7	0	2	0	1
8	-2	0	-1	0
9	-4	-2	-2	-1

Consumer's Equilibrium: Law of Equi-Marginal Utility



(a)



(b)

Explanation of figure

- Suppose, price of both x and y good is equal, as Rs.2 and his/her total budget is Rs.10. Consumer has capacity of buying maximum 5 unit of any one or both goods. consumer buys 2 units of x and 3 units of Y goods from his/her fixed budget Rs.10, and maximum total utility is 48 as marginal utility from last unit of X and Y goods are equal, which is 4.
- If consumer purchase 1 additional unit of x good, then s/he has to decrease the buying unit of Y due to budget limitation. If this new plan of combination of 3 units of X (2+1) and 2 units of Y (3-1) incur Gain from X good is area ABCD and loss equal to area of Y goods is EFGH. Thus consumer has to bear loss in total utility due to execution of new plan because Loss EFGH is greater than gain ABCD as Marginal utility of last unit of both good are not equal.
- So If marginal utility from last unit of both goods equal, Total utility is maximum.

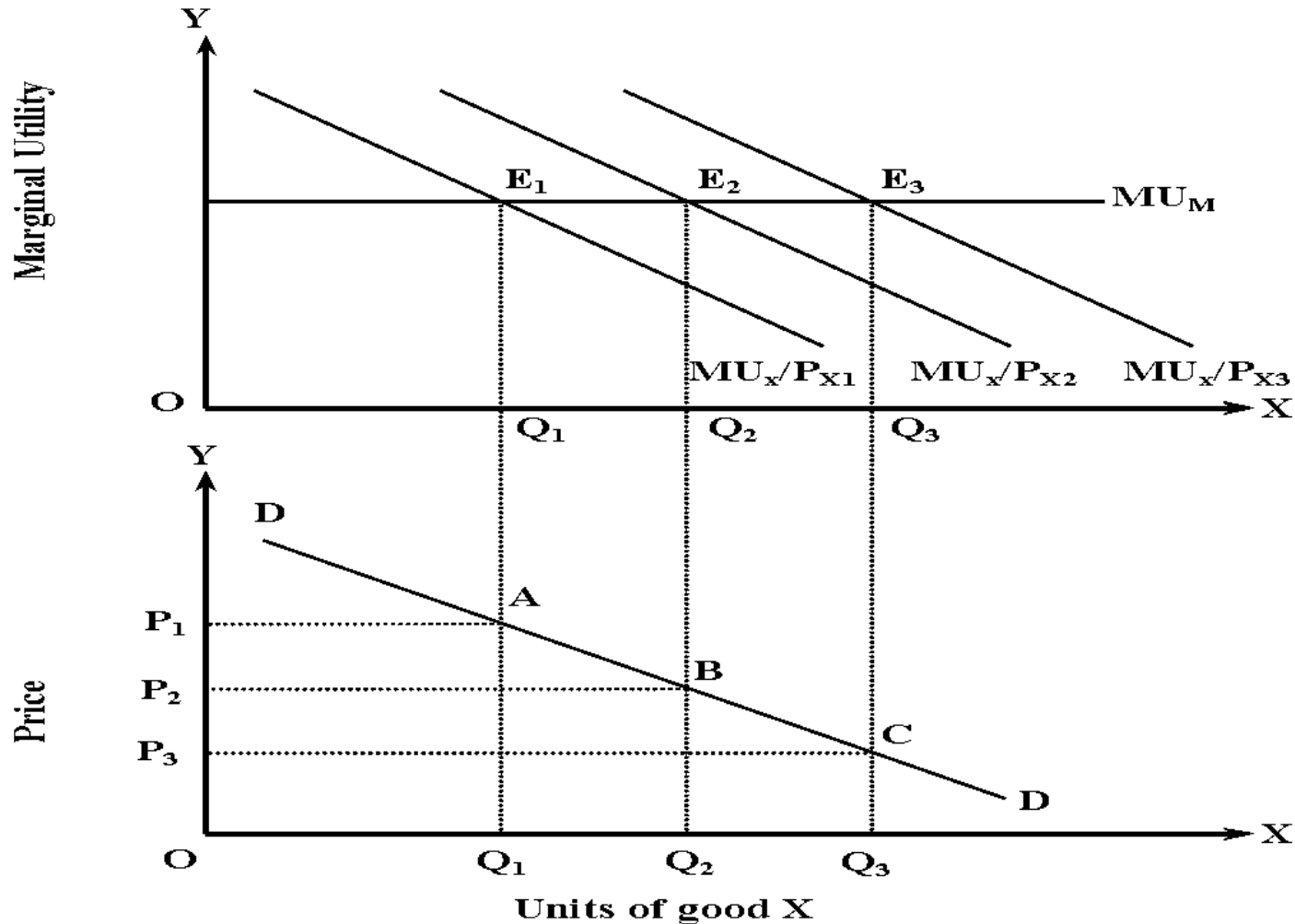
Derivation of Demand Curve from Law of Equi-Marginal Utility

According to the law of equi-marginal utility, the consumer is in equilibrium in regard to his purchases of various goods when marginal utilities of the goods are proportional to their prices. Thus the consumer is in equilibrium when he is buying the quantities of the two goods in such a way that following proportionality rule:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \underline{MU_m}$$

This can be shown in figure:

Derivation of Demand Curve from Law of Equi-Marginal Utility



Criticisms of Cardinal Approach

Following are the major criticisms of Marshallian Cardinal Approach:

1. **Cardinal measurement of utility is not correct:** Marshall assumes that utility is measurable cardinally, i.e. quantitatively. But it is argued that utility is subjective term which can neither be measured nor expressed quantitatively. In this regard, **J.R. Hicks** and **R.G.D. Allen** assumed that utility as ordinal. If consumers consume the goods, the utility derived from these goods can be compared.
2. **Constancy of marginal utility of money:** Marshall assumes that marginal utility of money remains constant. But the consumer consumes one commodity and after another the money will give more marginal utility because of limited amount of money. Thus, the Marshallian assumption of constancy of marginal utility of money is not acceptable.
3. **Cardinal utility analysis does not split-up price effect in to income effect and substitution effect:** The decrease in price of goods increases the purchasing power and real income of the consumer. Thus, it is necessary to split up price effect into income effect and substitution effect. But this point is missed in the cardinal approach.
4. **It is not applied in indivisible goods:** Cardinal utility analysis doesn't explain anything about the demand for indivisible goods such as TV, computer etc. generally, only one unit of these goods purchased by consumer at a time.
5. Diminishing Marginal utility is not valid in some goods: eg hobby of collecting ticket

Ordinal Utility Analysis

- The ordinal utility approach was started by F. Y. Edgeworth in 1881 AD to show the possibility of commodity exchange between two individuals.
- Ordinal utility analysis was fully developed by J. R. Hicks and R.G.D. Allen in 1934.
- Ordinal Utility analysis is mainly based on ordinal measurement of utility.
- This approach of Utility analysis uses indifference curve to analyze consumer's behaviour.

Ordinal Utility Analysis

Utility is only a psychological or subjective factor. So, this can be felt but not measured in a numerical form

According to **P.A. Samuelson and William D. Nordhaus**, *“In ordinal utility approach consumers need to determine only their preference ranking of bundles of commodities.”* It is based on the following assumptions.

1. **Rationality:** The consumer is assumed to be rational, rational in the sense that he/she tries to maximize the satisfaction from limited resources. It is assumed he has full knowledge of all relevant information.
2. **Ordinal utility:** It is assumed that the consumer can rank their preference according to the satisfaction of each basket.
3. **Consistency of choice:** It is assumed that the consumer is consistent in his choice, that is, if in one period he chooses bundle A over B, he will not choose B over A in another period if both bundles are available to him.
4. **Transitivity of choice:** It is assumed that consumer's choices are characterized by transitivity: if bundle A is preferred to B, and B is preferred to C, then bundle A is preferred to C. symbolically, if $A > B$, and $B > C$, then $A > C$.
5. **Diminishing Marginal rate of substitution:** The marginal rate of substitution is a rate at which a consumer is willing to substitute one commodity for another.

Indifference Curve Meaning

- The indifference curve explains consumer's behavior in terms of his preference or making for different combinations of two goods, say 'x' and 'y'.
- **Indifference curve is a locus of various combinations of two goods which give the same level of satisfaction.**
- **Assumptions of Indifference Curve**

(i) Rationality:

The consumer is rational and he aims at the maximization of his utility, given his income and market prices. It is assumed he has full knowledge or information of the consuming goods.

(ii) Ordinal measurement of utility:

It is taken as the consumer can rank his preferences according to satisfaction of each combination. Only ordinal measurement is required.

Indifference Curve Meaning

(iii) Transitivity:

It is assumed that the consumer's preferences are in such a way that, if combination A is preferable to B, and B to C, then A is preferable to C. If $A > B$ and $B > C$, then $A > C$.

iv) Consistency:

It is assumed that the consumer is consistent in his choice. If the consumer's preferences is $A > B$ then at the same time $B > A$.

Indifference Curve Meaning

(v) Diminishing Marginal Rate of Substitution (DMRS):

The marginal rate of substitution is the rate at which a consumer is willing to substitute one commodity (x) for another (y). So that the total satisfaction remains the same. So, the assumption is that $\Delta y / \Delta x$ goes on decreasing, when a consumer continuous to substitute 'x' for 'y'.

$$MRS(x, y) = (\text{diminishing})$$

Indifference Curve Analysis

The indifference curve analysis measures utility ordinally. It explains consumer's behaviour in terms of his preference or making for different combinations of two goods. Indifference curve is a locus of those combinations of any two goods which gives the same level of satisfaction to the consumer. This implies that consumer is indifferent between different combinations or all combinations are equally preferable to him.

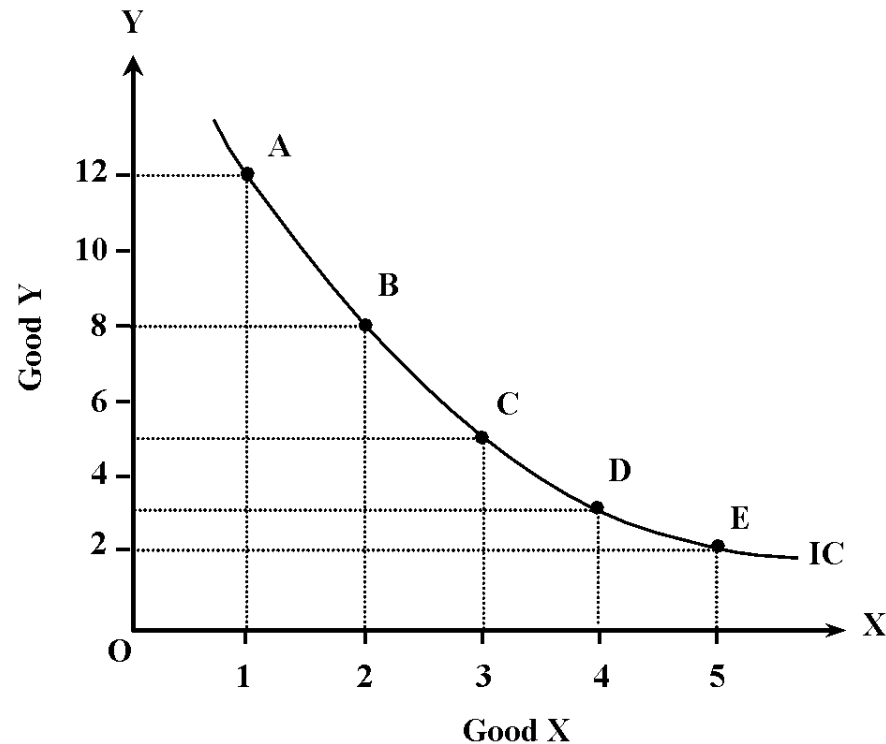
The indifference schedule as:

Combination	Goods X	Goods Y
A	1	12
B	2	8
C	3	5
D	4	3
E	5	2

In the table, the alternative combinations of commodity X and Y yield the same level of satisfaction to the consumer. Thus, the consumer is indifferent as to whether he gets the combination A of 1 unit of X and 12 units of Y or combination B with 2 units of X and 8 units of Y and similarly the combination E with 5 units of X and 2 units of Y. all these combinations A, B, C, D, and E give the equal satisfaction to the consumer.

Indifference Curve Analysis

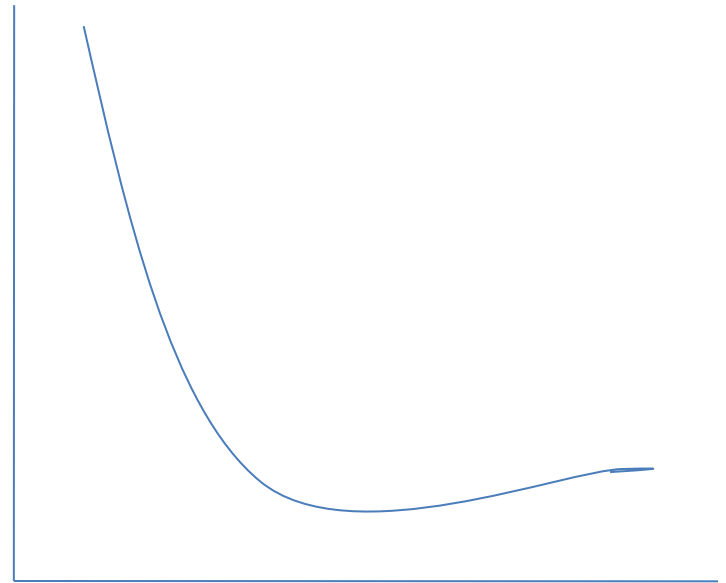
- It can be presented with the help of following figure:



In figure, goods X and Y are measured along the X-axis and Y-axis respectively. IC is the indifference curve derived on the basis of indifference schedule. It states that when we consume more units of X goods, we must have to reduce the consumption of Y goods.

IC

- An indifference curve (IC) is a locus of different combinations of two goods which gives the same level of satisfaction to the consumer. In figure,



Indifference curve

Indifference schedule: An Indifference schedule can be defined as a schedule of various combinations of the two goods that will equally be acceptable to the consumer. Eg.

Combination	X-Good	Y-Good	Utility
A	1	20	U
B	2	15	U
C	3	11	U
D	4	8	U
E	5	6	U

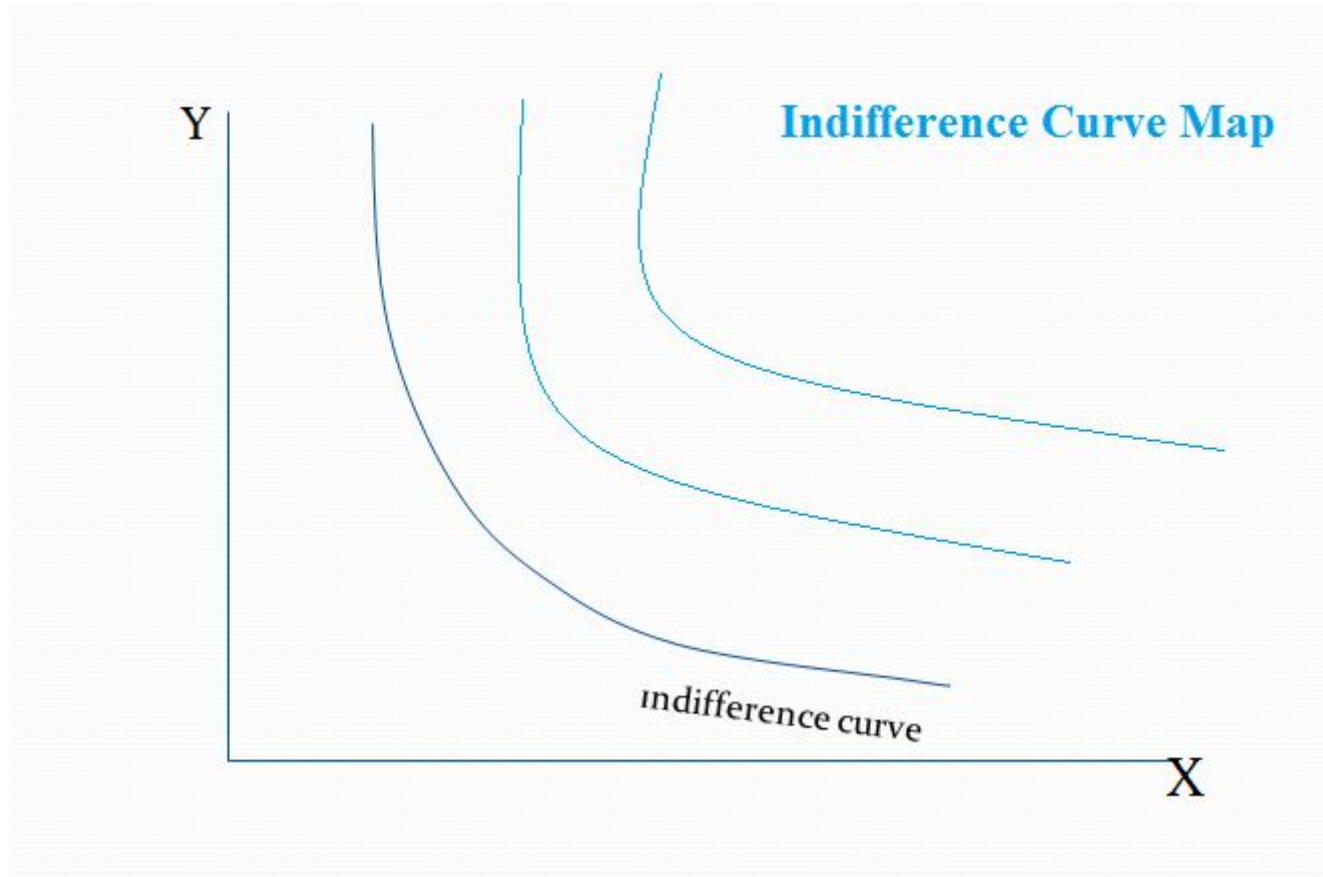
Indifference curve derivation

Let us suppose that a consumer makes combination A, B, C, D and E of two commodities 'X' and 'Y'. All these combinations yield him the same level of satisfaction.

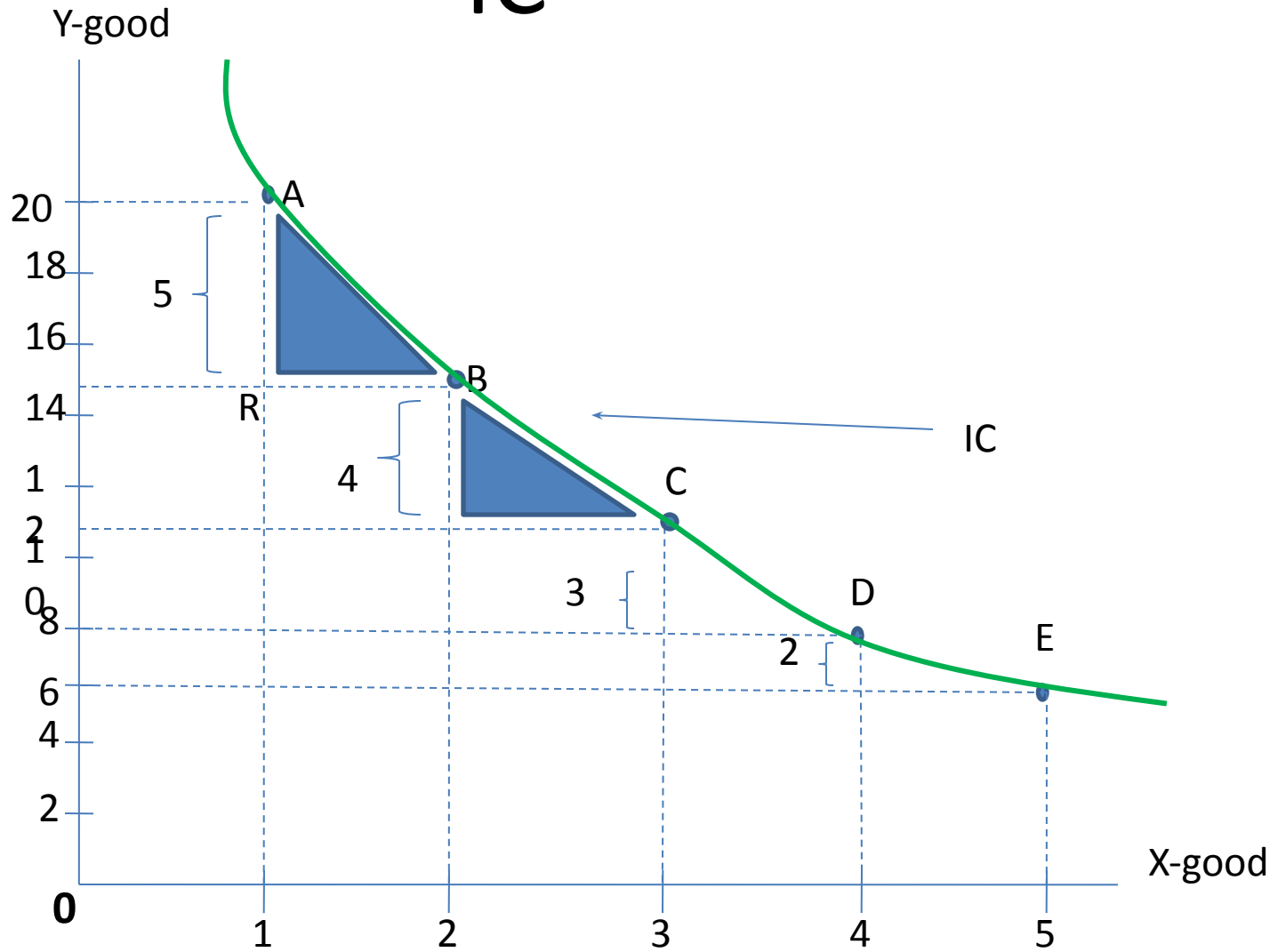
The consumer is therefore indifferent between the various combinations, which are presented as below:

Combination	X-Good	Y-Good	Utility
A	1	20	U
B	2	15	U
C	3	11	U
D	4	8	U
E	5	6	U

Indifference curve Map



IC

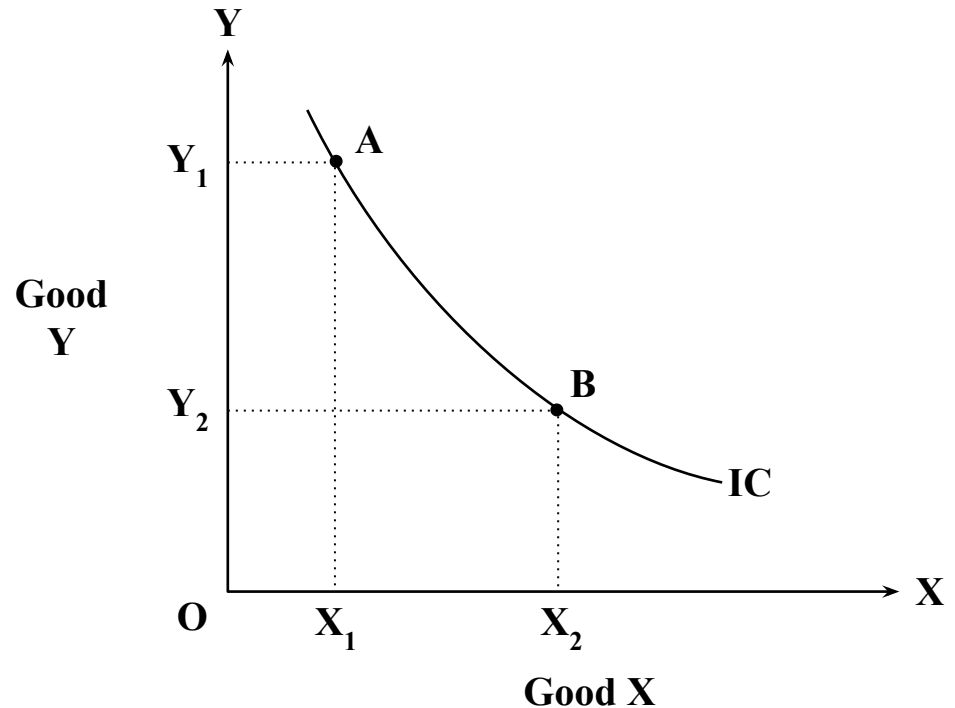


Properties of Indifference Curve

Indifference curves have certain properties reflecting the assumptions about consumer behaviour.

1. Indifference curves slopes downward to the right

An indifference curve slopes downward from left to right, because when the consumer wants more units of one goods, he will have to reduce the units of other goods, if he wants to remain at the same level of satisfaction.



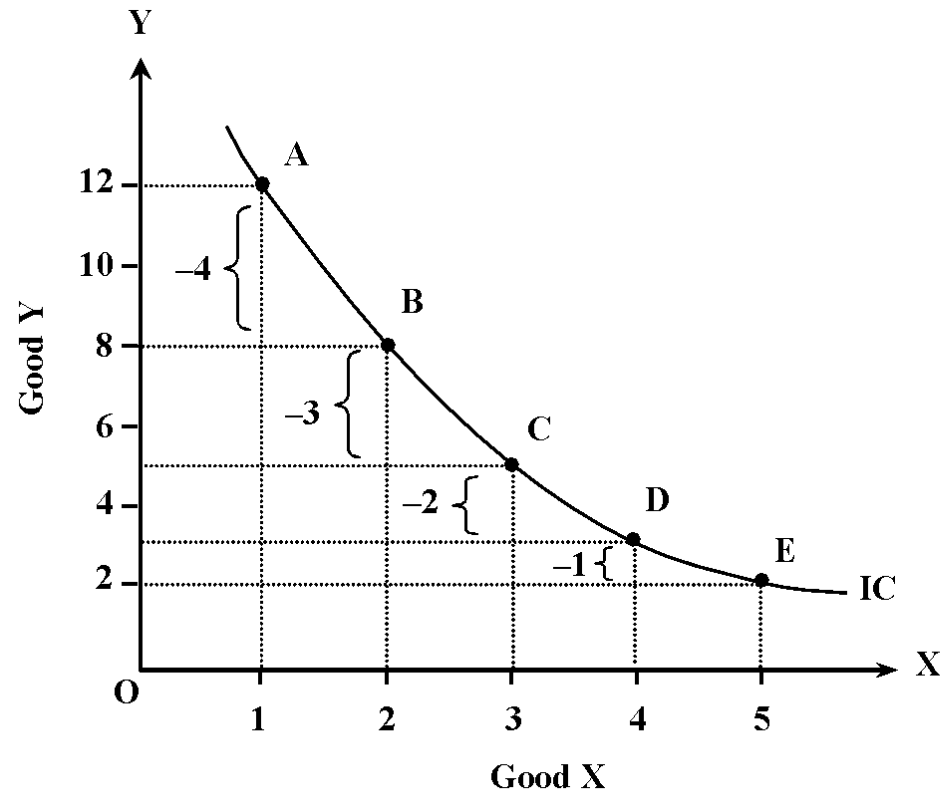
Properties....

- In the figure, both combination A and B yield the same level of satisfaction. When consumer consumes more units of good X, we also have to go on reduce the consumption of goods Y.
- **An indifference curve cannot take following shapes**
 - a. Upward sloping curve from left to the right
 - b. Horizontal straight line parallel to X-axis
 - c. Vertical straight line parallel to Y-axis

Properties.....

2. An indifference curve is convex to the origin

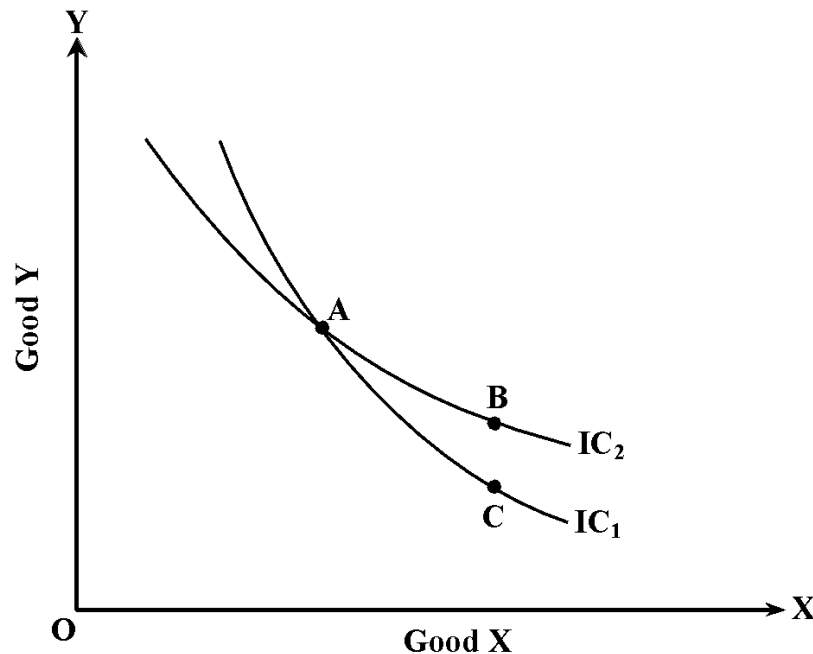
An indifference curve is usually convex to the origin. In other words, indifference curve is relatively flatter in its right-hand portion and relatively steeper in its left-hand portion. Therefore, an indifference curve is convex to the origin.



properties

3. Indifference curves cannot intersect each other

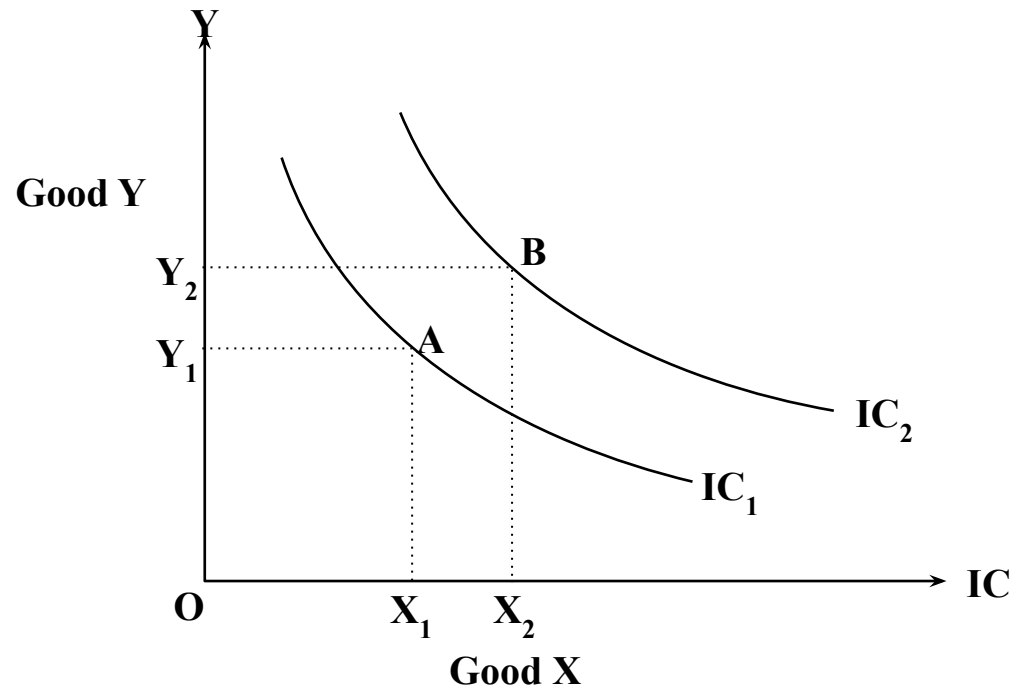
Indifference curves cannot be intersecting each other. In other words, only one indifference curve will pass through a point in the indifference map. If they intersect, the consumer's preferences would not be consistent and transitive.



properties

4. Higher indifference curve represents the higher level satisfaction

The higher indifference curve will represent a higher level of satisfaction than a lower indifference curve. In other words, the combinations which lie on a higher indifference curve will be preferred to the combinations which lie on a lower indifference curve.



Marginal Rate of Substitution (MRS)

- The marginal rate of substitution is the rate of exchange between some units of goods X and Y which are equally preferred. In other words, **marginal rate of substitution is the rate at which one commodity is substituted for another to maintain same level of satisfaction.** The marginal rate of substitution of X for Y $(MRS)_{xy}$ is the amount of Y that will be give up for obtaining each additional unit of X. Thus

Combination	Goods X	Goods Y	MRS	$MRS_{xy} = \Delta Y / \Delta X$
A	1	12	-	-
B	2	8	$1X = 4Y$	-4
C	3	5	$1X = 3Y$	-3
D	4	3	$1X = 2Y$	-2
E	5	2	$1X = 1Y$	-1

Law of diminishing Marginal Rate of Substitution (DMRS)

Statement: Marginal rate of substitution (MRS) always goes on declining where the MRS is the rate at which one commodity is substituted for another to maintain the same level of satisfaction.

Assumptions:

1. Rational consumer.
2. Ordinal measurement of utility.
3. Two wants are satiable at a time.
4. Consistency, if $A > B$, at the same time $A > B$.
5. Transitivity, if $A > B$, $B > C$ then $A > C$.
6. Consumer has non-satiety nature.
7. Diminishing marginal rate of substitution exists.

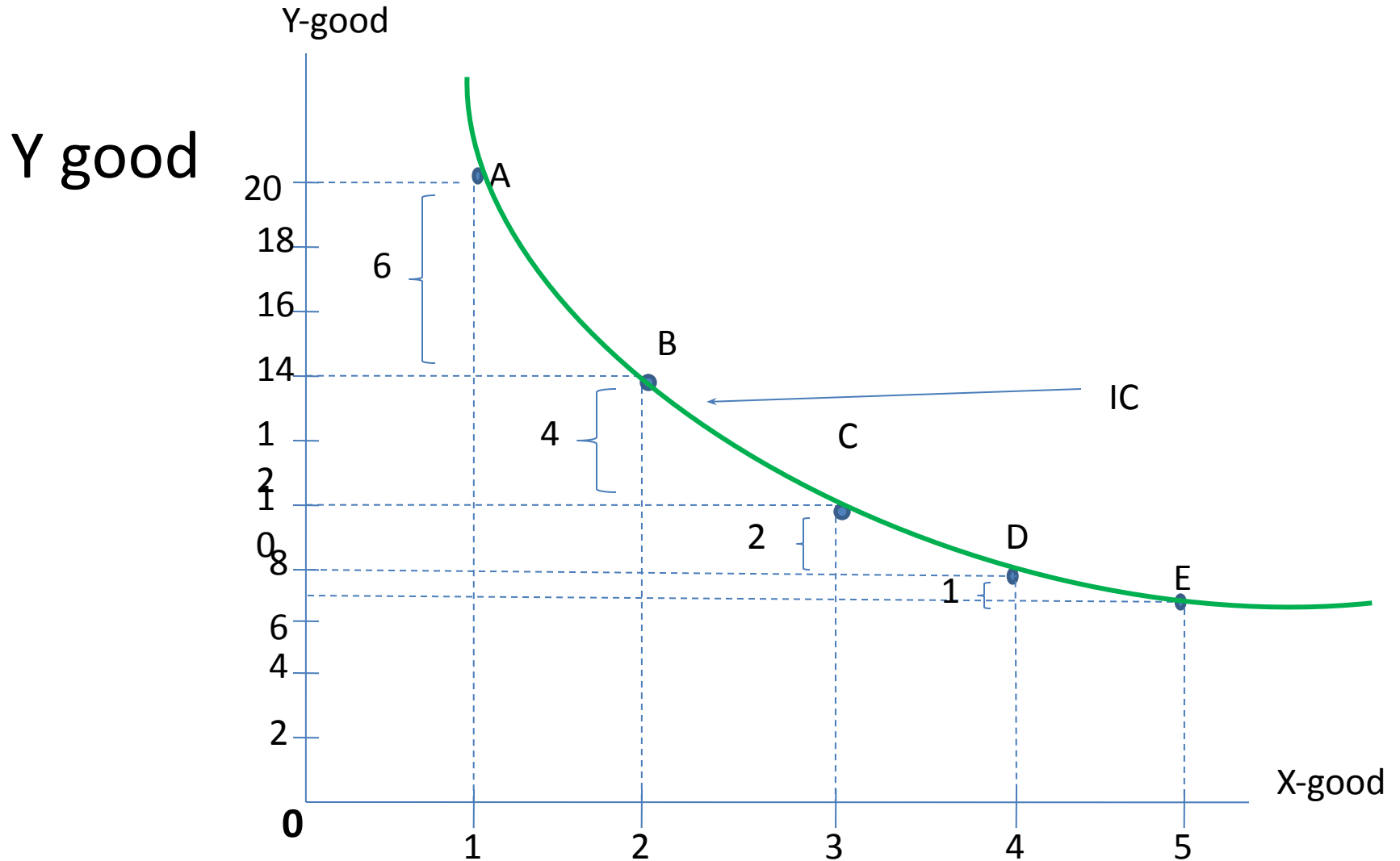
MRS_{xy}

- This law says that to increase one unit of any commodity, quantity of another commodity should be decreased to keep the same level of satisfaction along an IC. The decreased quantity of the commodity is known as MRS.
- Let there are two goods X and Y then the MRS between X and Y can be defined as the amount of Y that a consumer is willing to give up so as to obtain one more unit of X-good. It can be explained with the help of following indifference schedule and indifference curve

MRS_{xy}

Combination	X-Good	Y-Good	Utility	MRS _{xy} = $-\Delta Y/\Delta X$
A	1	20	U	NA
B	2	14	U	6
C	3	10	U	4
D	4	8	U	2
E	5	7	U	1

MRS_{xy} Graphically



Explanation of Graph

- In above table and figure, the consumer has sacrificed 6 units of Y commodity to get one unit of X commodity. Similarly, in the 3rd combination the consumer has sacrificed 4 units of Y-commodity to get one more unit of X commodity. That means marginal rate of substitution is 4Y for 3rd X, 2Y for 4th X and 1Y for 5th X. In this ways the MRS goes on diminishing.
- In figure, the diminishing marginal rate of substitution is shown by the downward sloping indifference curve IC.

MRS xy

- When the consumer gets more and more of commodity X, his desire for X-good decline. So he is prepared to sacrifice less commodity Y. therefore, the rate of substitution declines.
- Mathematically,

To keep the same level of satisfaction

Gain = Loss

$$MU_X \cdot \Delta X = - MU_Y \cdot \Delta Y$$

$$\text{or, } \Delta Y / \Delta X = - MU_X / MU_Y$$

Therefore, $MRS_{xy} = - MU_X / MU_Y$

- Hence, MRS_{xy} reflects the slope of IC or it is the ratio between marginal utilities of two goods

Why does MRS diminish?

- 1. Goods are not perfect substitute:** Since the imperfect substitution, the MU attached to the additional quantity of a commodity decreases faster in relation to the other commodity. When the quantity of X increases, quantity of Y decreases, it becomes increasingly costlier for the consumer to sacrifice more units of Y good for one unit of X. Thus, the MRS declines.
- 2. Availability of quantity of goods:** The consumer's willingness to sacrifice is higher if its stock is higher and it is lower when its stock is smaller. It is rational consumer's behavior. Thus, the MRS diminishes.

Budget line/ Budget constraint/ price line:

A budget line is a locus of the combinations of any two goods that can be purchased by spending all fixed income at given prices. Mathematically, the budgetary constraint, in two commodity model can be expressed as

$$P_x \cdot Q_x + P_y \cdot Q_y = B \dots \dots \dots (i)$$

$$\dots \dots \dots Q_x = \frac{B}{P_x} - \frac{P_y}{P_x} \cdot Q_y \dots \dots \dots (ii)$$

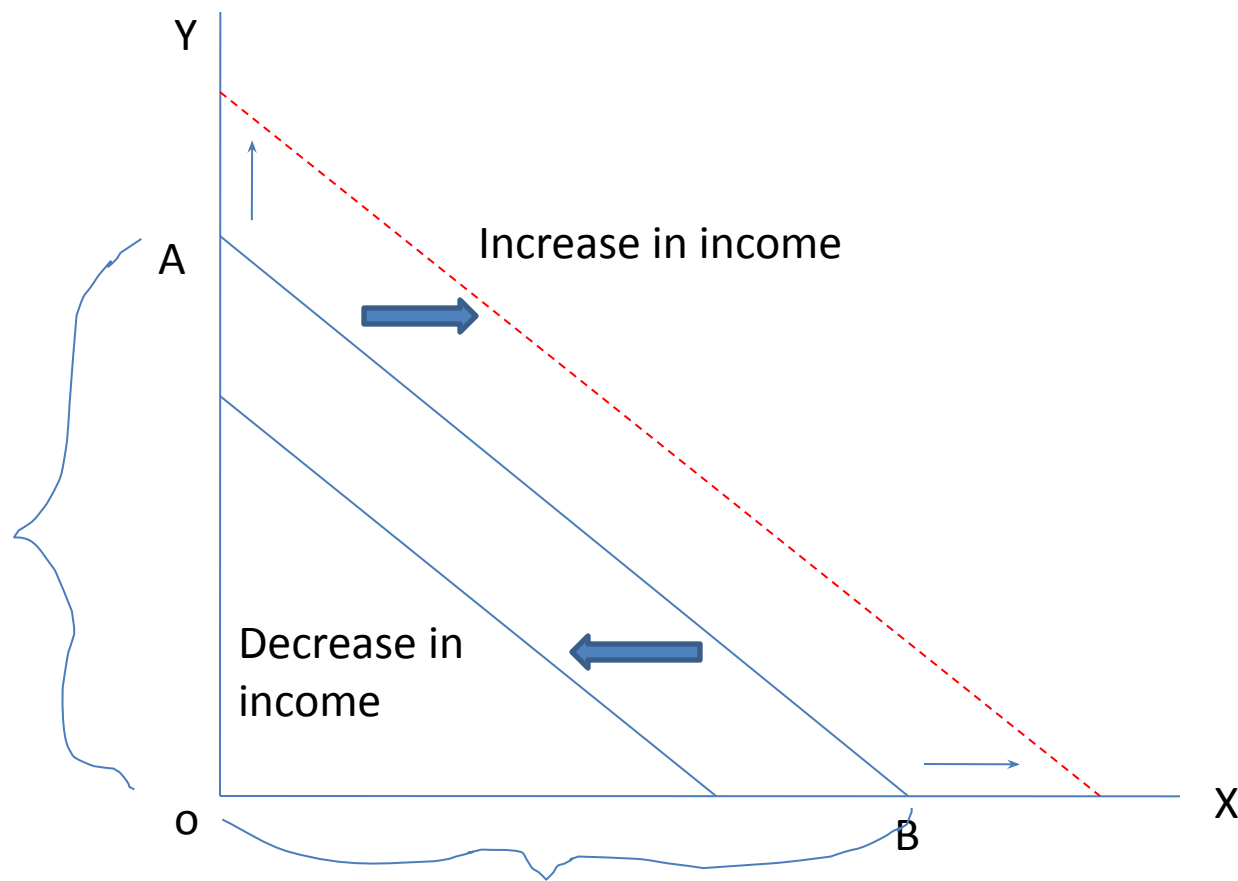
Budget line

$$Q_y = \frac{B}{P_y} - \frac{P_x}{P_y} \cdot Q_x \dots\dots\dots(iii)$$

- The equations (ii) and (iii) are the budget line by which value of Q_x and Q_y can be calculated.
- Where,
 - P_x = Price of X-Good
 - P_y = Price of Y-Good
 - Q_x = Quantity of X-Good
 - Q_y = Quantity of Y-Good
 - B = budget (fixed)

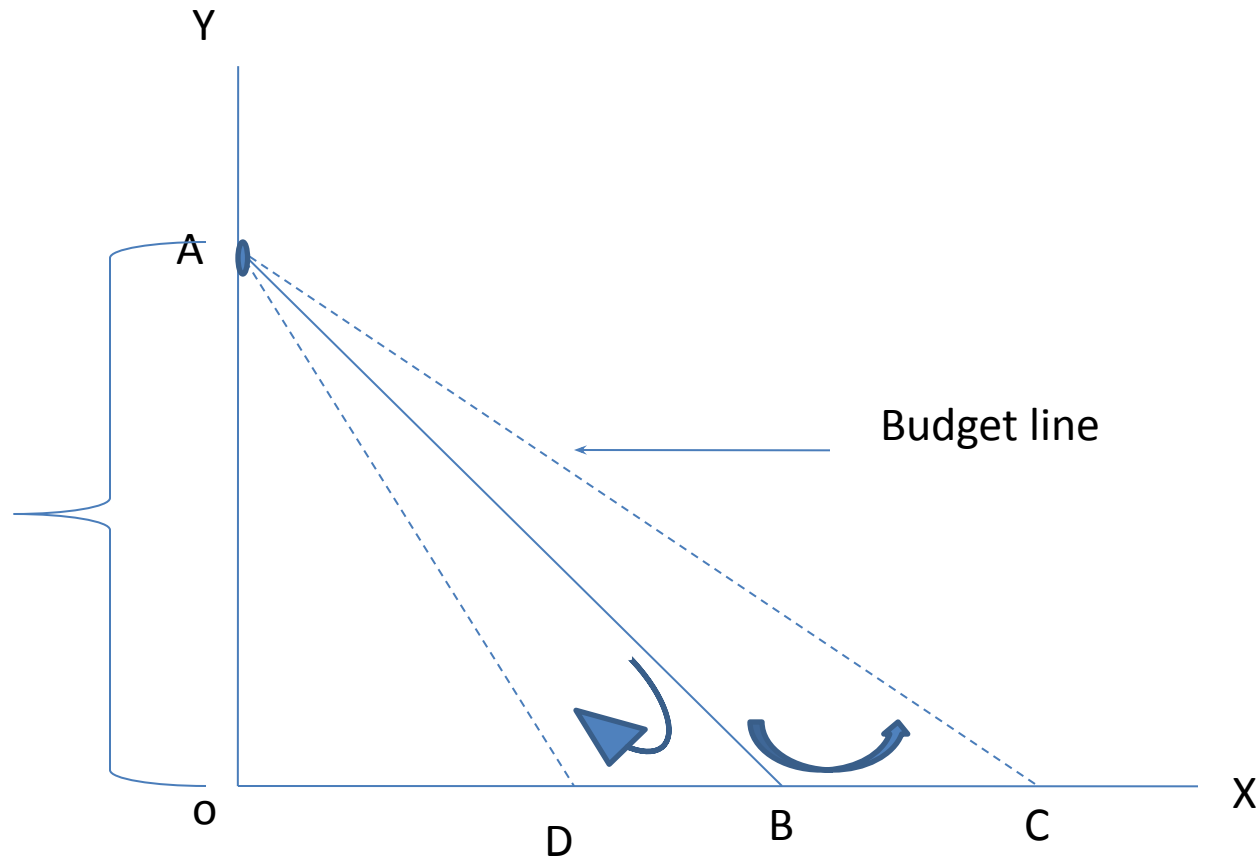
When income increases with given prices of both goods, budget line shifts toward right. When decreases the budget line shifts leftward.

Figure,



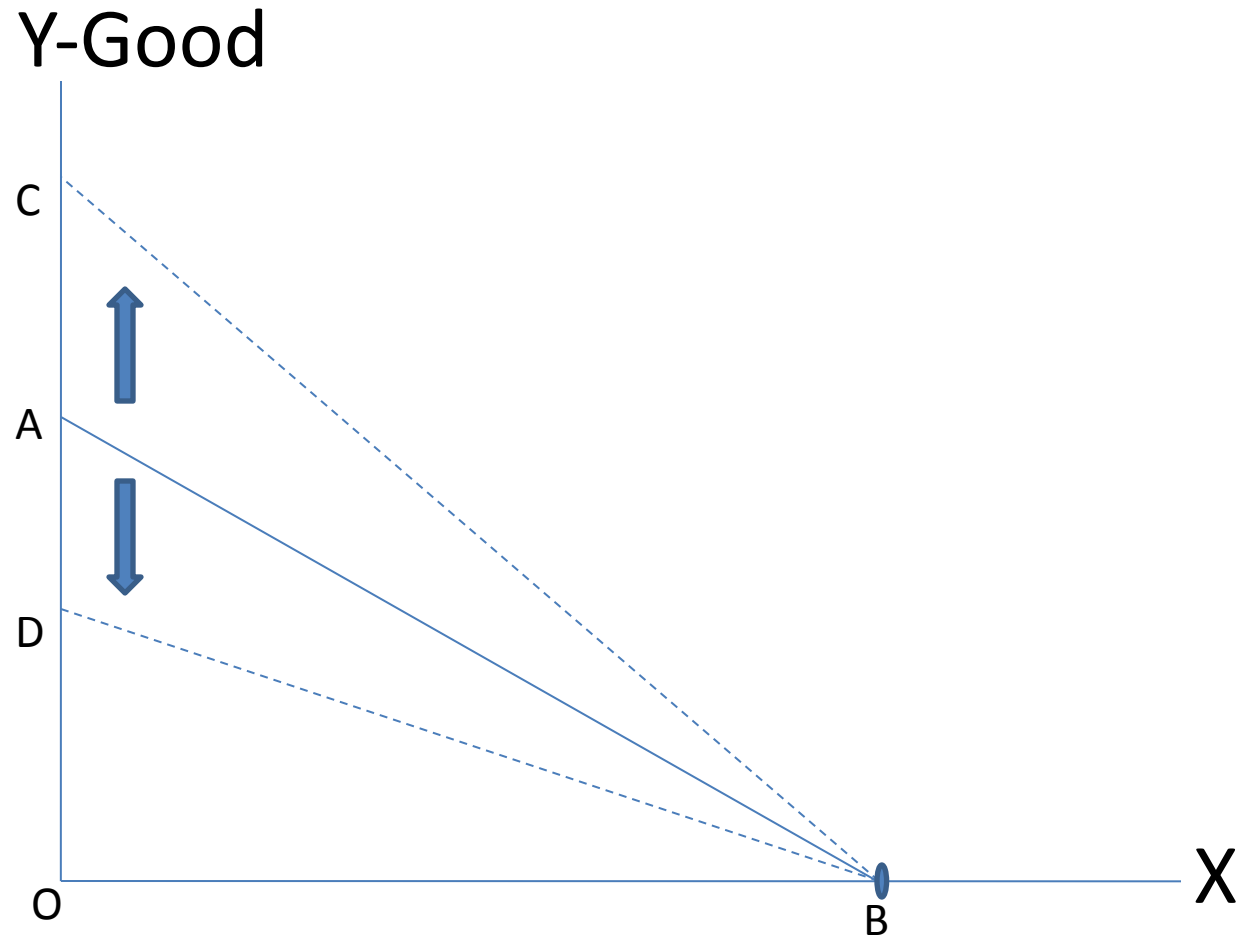
Keeping the income and price of Y constant, when price of X decreases the budget line swing towards right and when price increases the budget line swings leftward.

Swing figure:



Keeping the income and price of X constant, when price of Y decreases the budget line swing upward and when price increases then budget line swings downward.

- Swing figure



Consumer Equilibrium

Statement: A consumer is in equilibrium when he/she maximizes his/her satisfaction under the budget constraint. **The consumer is in equilibrium position where the budget line is tangent to the highest possible indifference curve.**

Assumptions:

1. Rational consumer.
2. Ordinal measurement of utility.
3. Two wants are satiable at a time.
4. Consistency, if $A > B$, at the same time $A > B$.
5. Transitivity, if $A > B$, $B > C$ then $A > C$.
6. Diminishing marginal rate of substitution exists.
7. Consumer consumes only two goods Say X and Y.

The following two conditions should be satisfied to be in equilibrium for the consumer.

1. The budget line should be tangent to the indifference curve. (necessary condition)
2. The IC must be convex to the origin at the point of tangency. (sufficient condition)

Consumer equilibrium can be explained with the following Figure:

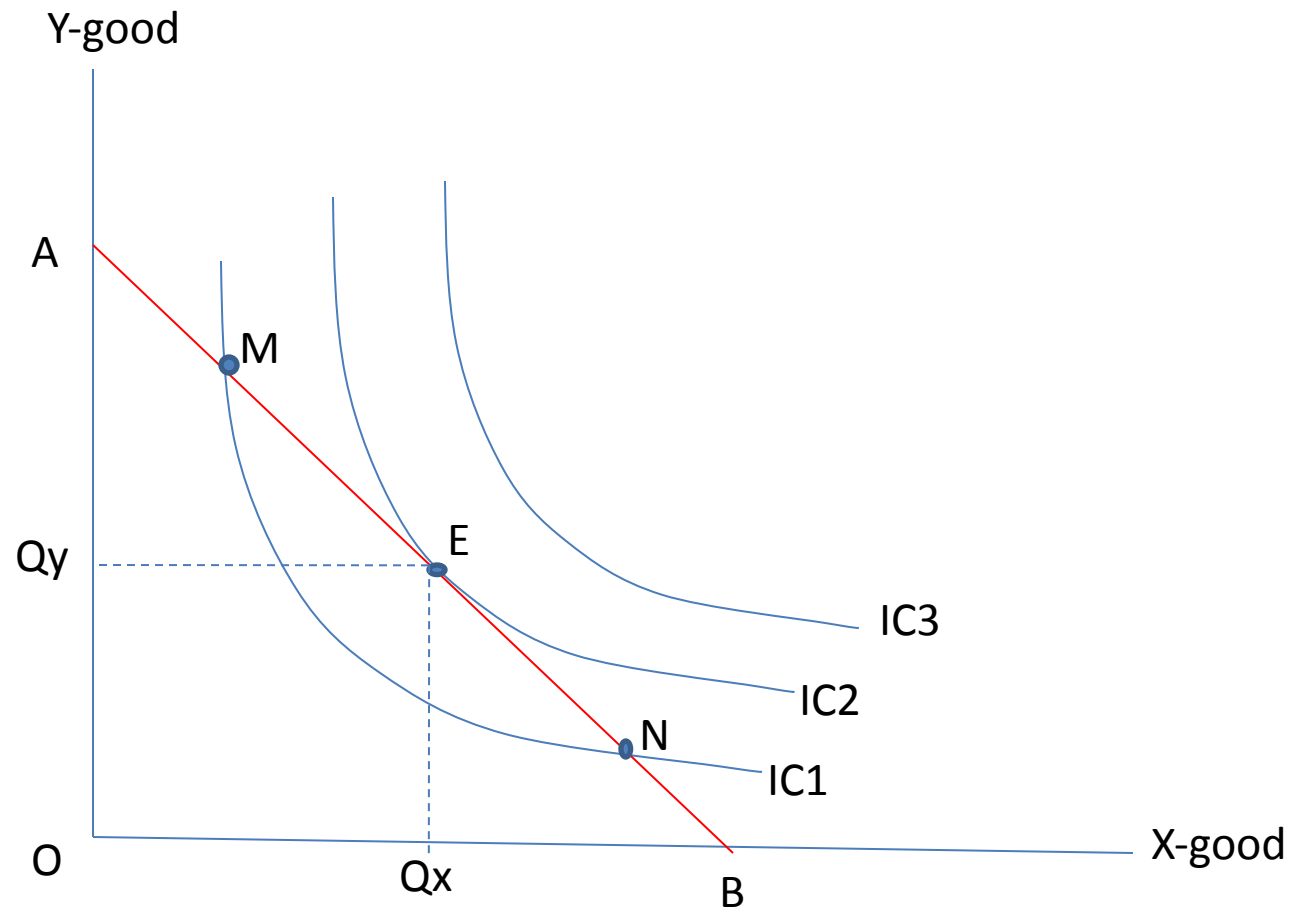


Figure: consumer's equilibrium

Explanation of figure

- In figure, Satisfaction at IC3 is desirable but not attainable and the satisfaction at IC1 is attainable but less than the IC2 therefore the consumer is in equilibrium at point E where the above mentioned two conditions are satisfied by consuming OQ_x quantity of X-good and OQ_y quantity of Y-good.

Here, the IC1 and budget line AB are intersected at points M and N. M contains more unit of Y-good and less unit of X-good. So the rational consumer substitute X-good for Y-good. Similarly point N contains more unit of X-good and less units of Y-good. So the consumer will substitute Y-good for X-good. This process of substitution will be continued to that point where the budget line will be tangent to the IC.

Income effect and derivation of Engel curve:

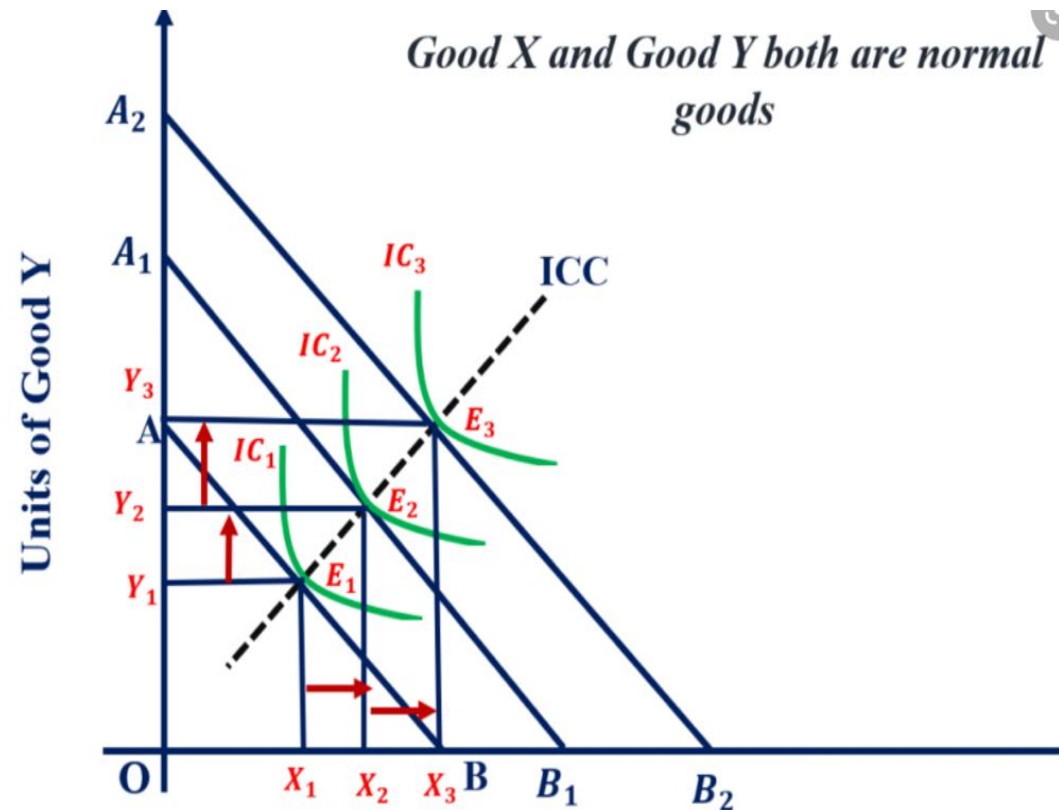
- **Income effect:** Income effect shows the total effect on demand for goods due to change in income of the consumer, other thing remaining the same. Income effect may be positive and negative.

Positive income effect: Positive income effect shows the total effect on demand for normal goods due to change in income of the consumer, other thing remaining the same. Income effect may be positive and negative.

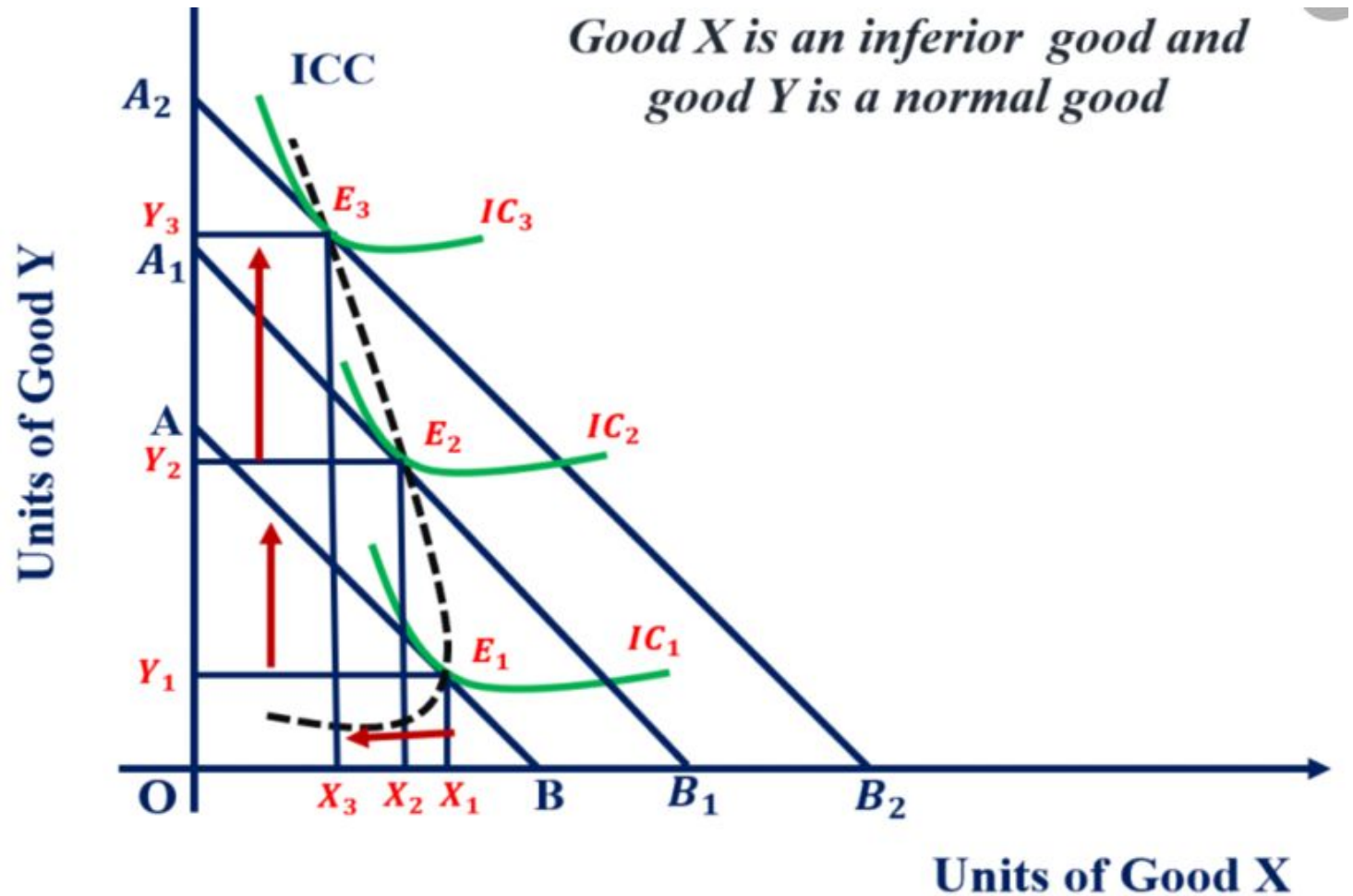
Negative income effect: Negative income effect shows the total effect on demand for inferior goods due to change in income of the consumer, other thing remaining the same. Income effect may be positive and negative.

Income consumption curve (ICC)

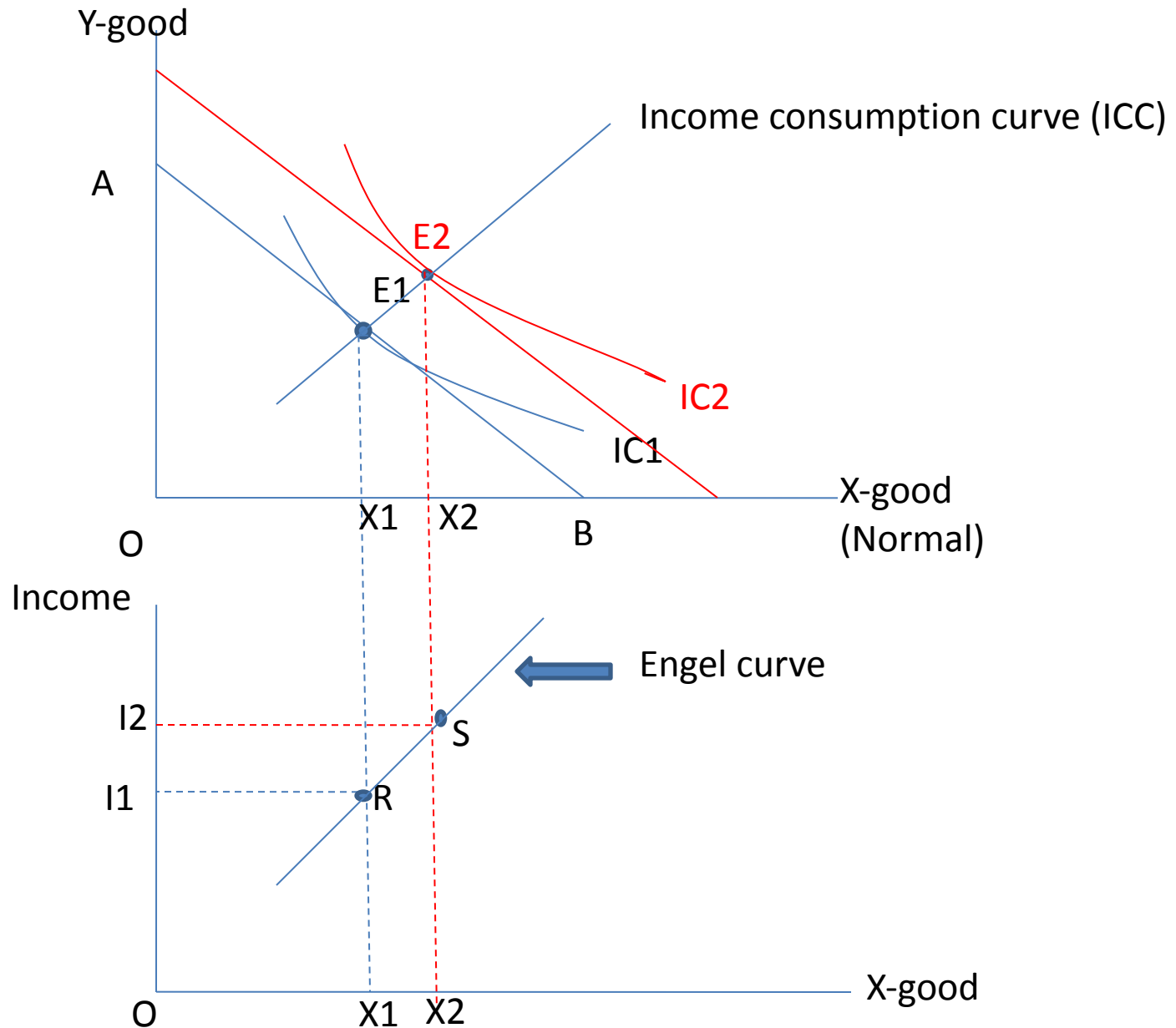
- Income consumption curve (ICC): The locus of equilibrium points of a consumer at various level of income is called ICC. Eg. Normal good case icc is as given



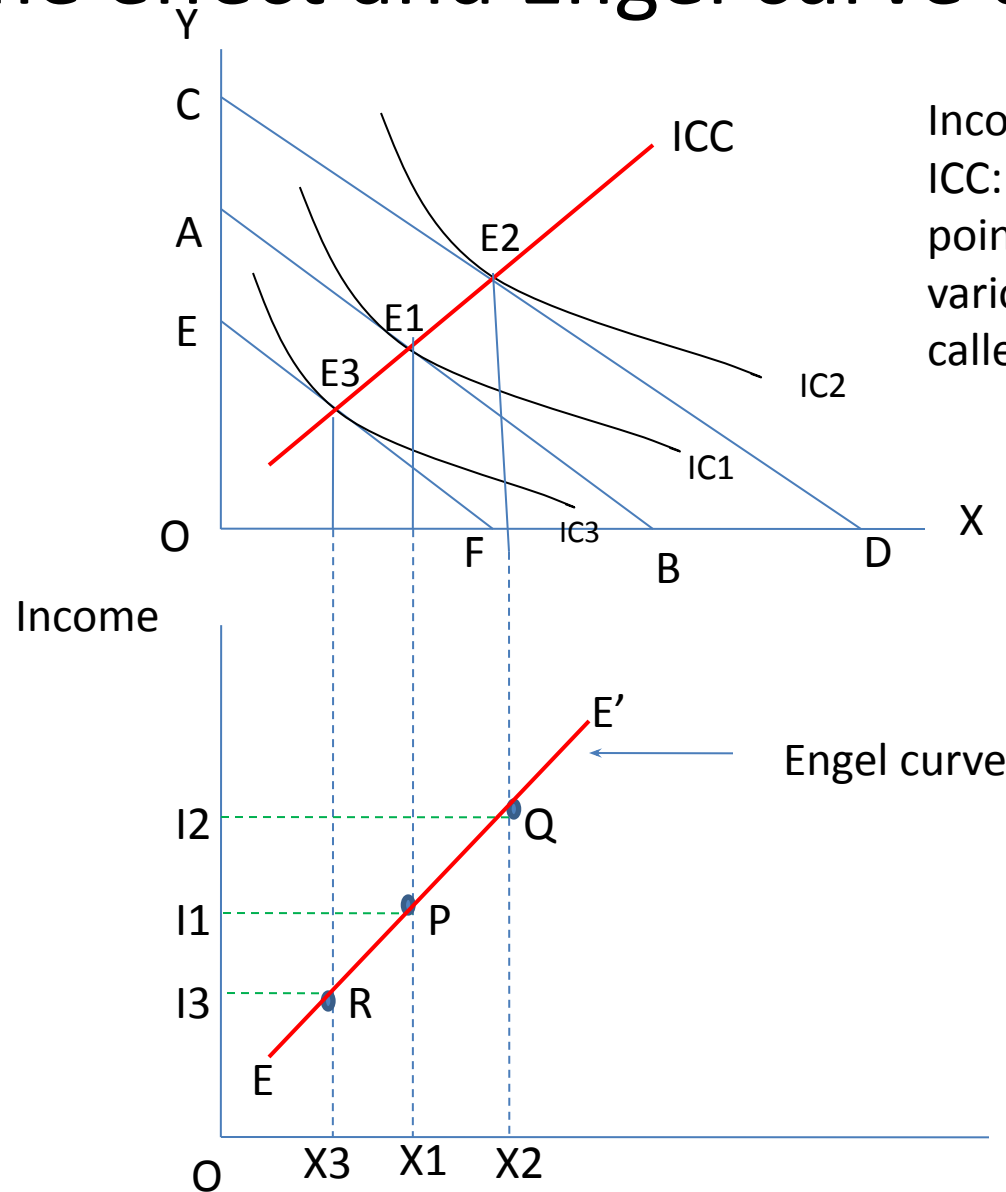
ICC in inferior goods case



Income effect and Engel curve derivation



Income effect and Engel curve derivation



Income consumption curve
ICC: The locus of equilibrium points of a consumer at various level of income is called ICC.

Simply, a curve which shows the relationship between income and quantity demanded i.e. income demand curve.

Qd (Normal good)

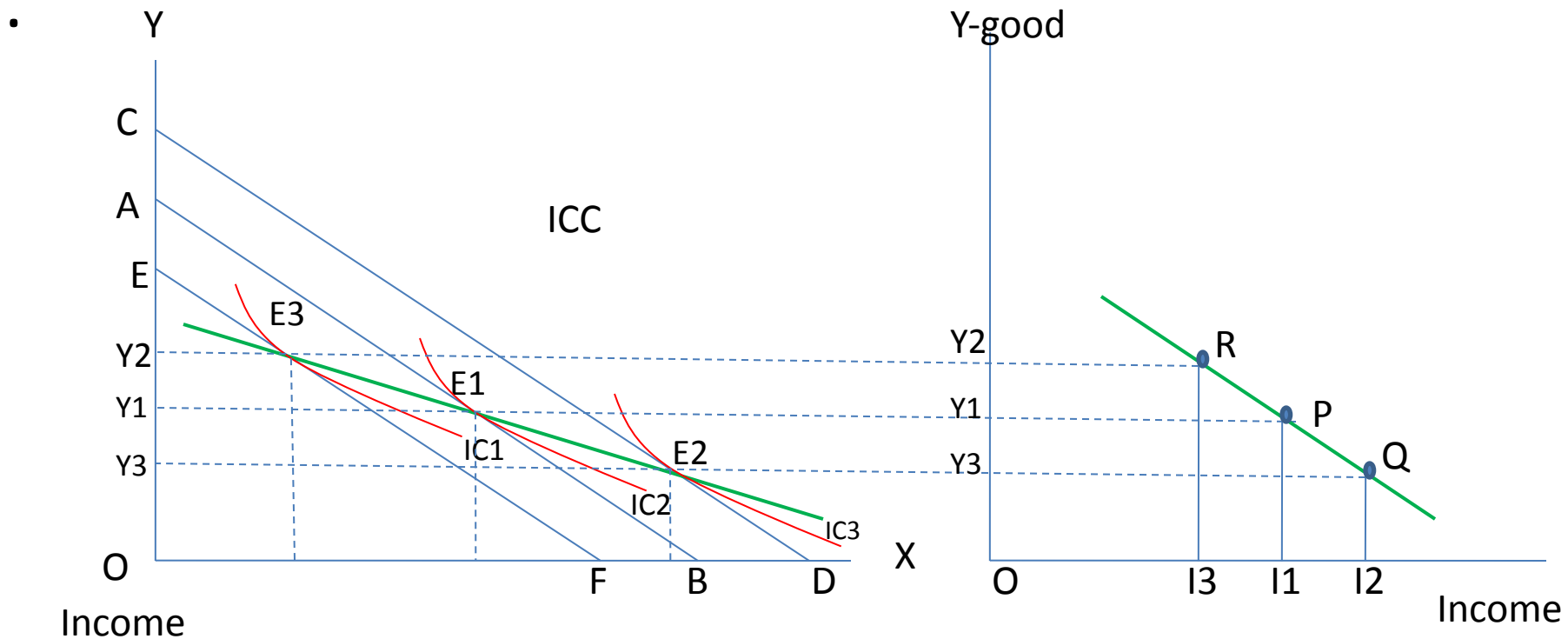
Explanation of figure

- In upper figure, AB is the budget line which is tangent to IC1.
- Initially the consumer is in equilibrium at E1 by consuming OX1 quantity of X-good and OY1 quantity of Y-good.
- Suppose income of the consumer is increased so that the budget line shifts outward to the position CD.
- This budget line is tangent to the higher indifference curve IC2.
- The quantity of X-good is also increased because it is normal good.
- Similarly when the income decreased, the budget line shifts towards origin to the position EF and the quantity of X-good also decreased.

Explanation

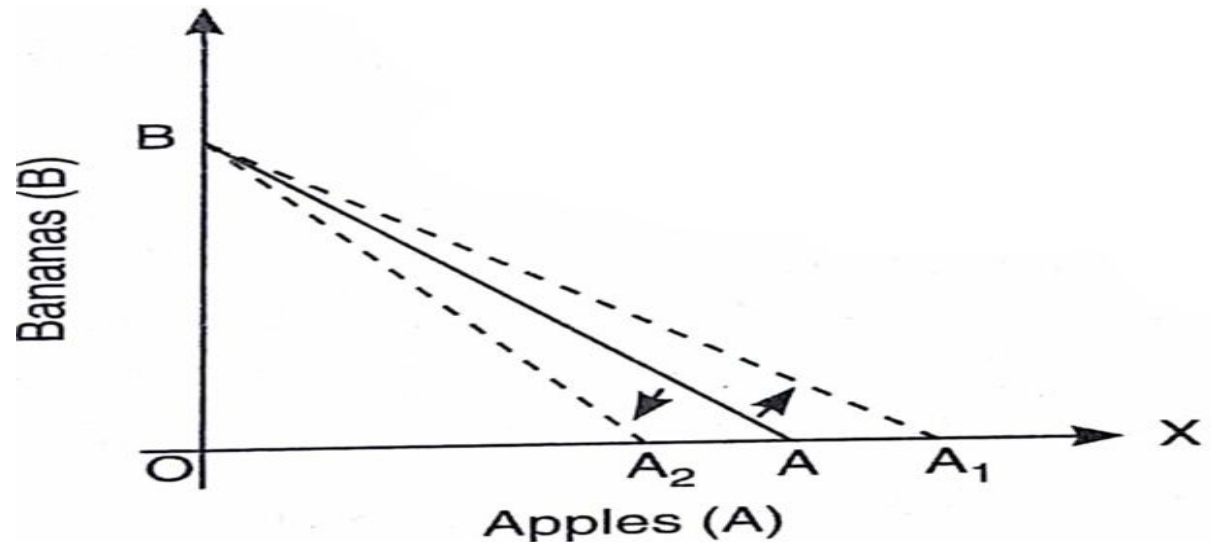
- In lower figure, quantity of X-good and income are measured along X-axis and Y-axis respectively.
- Quantity demanded of X-good is copied from upper figure. When the income is increased from I_1 to I_2 the quantity demanded of X also increased from X_1 to X_2 .
- Similarly, when income is decreased from I_1 to I_3 , quantity demanded of X also decreased from X_1 to X_3 . by joining the combinations of income and quantity (P, Q and R) we get positively Engel curve EE' .

Negative income effect (inferior goods case)



Change in Prices of Commodities

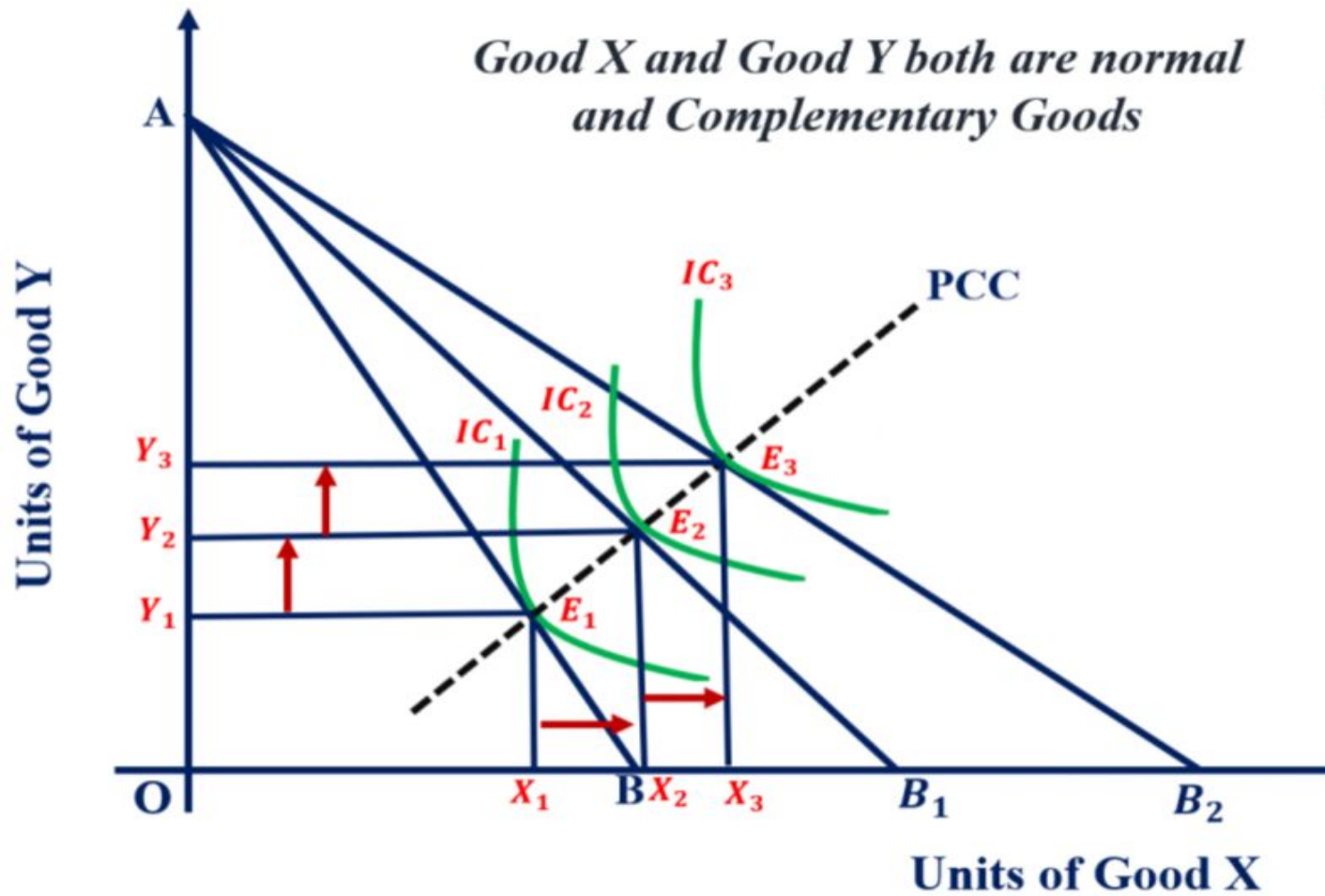
- Change in Price of Commodity X. Suppose price of commodity X falls, price of commodity Y and income of consumer remain constant. As a result, consumer can buy more quantity of commodity X. The budget line shifts rightward and new budget line becomes O BA1. When price of X rises, it shifts leftward to BA2



Price Effect

- Price effect refers to the effect on consumer equilibrium due to the change in price of the commodity, other things remaining the same.
- Price consumption curve (PCC): The locus of equilibrium points of a consumer at various level of price is called PCC.
- A curve which shows the relationship between Price and quantity demanded i.e. demand curve.

PCC



Price effect and derivation of PCC (Price consumption curve)

Price effect shows the total effects for a commodity due to change in price of same commodity, other things being equal.

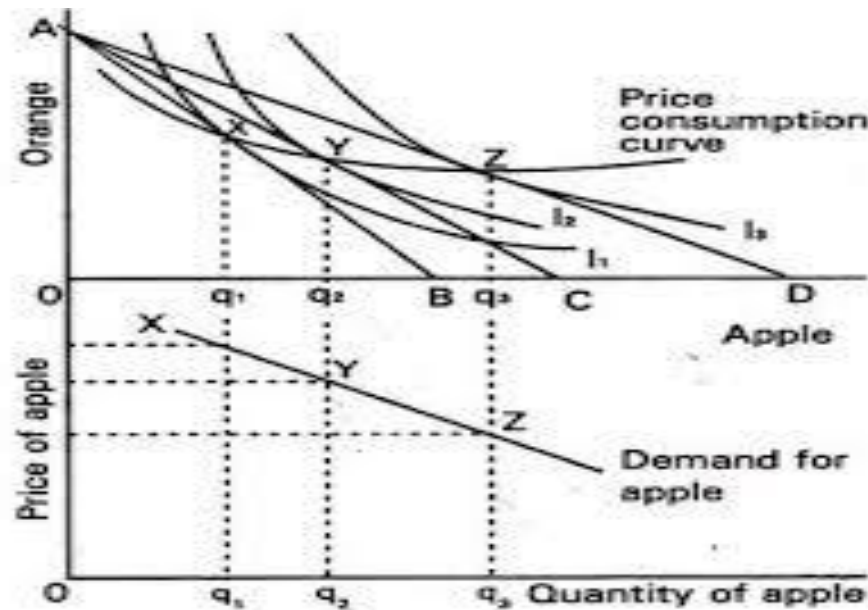


Fig. 4.13. Deriving the demand curve for apple from PCC

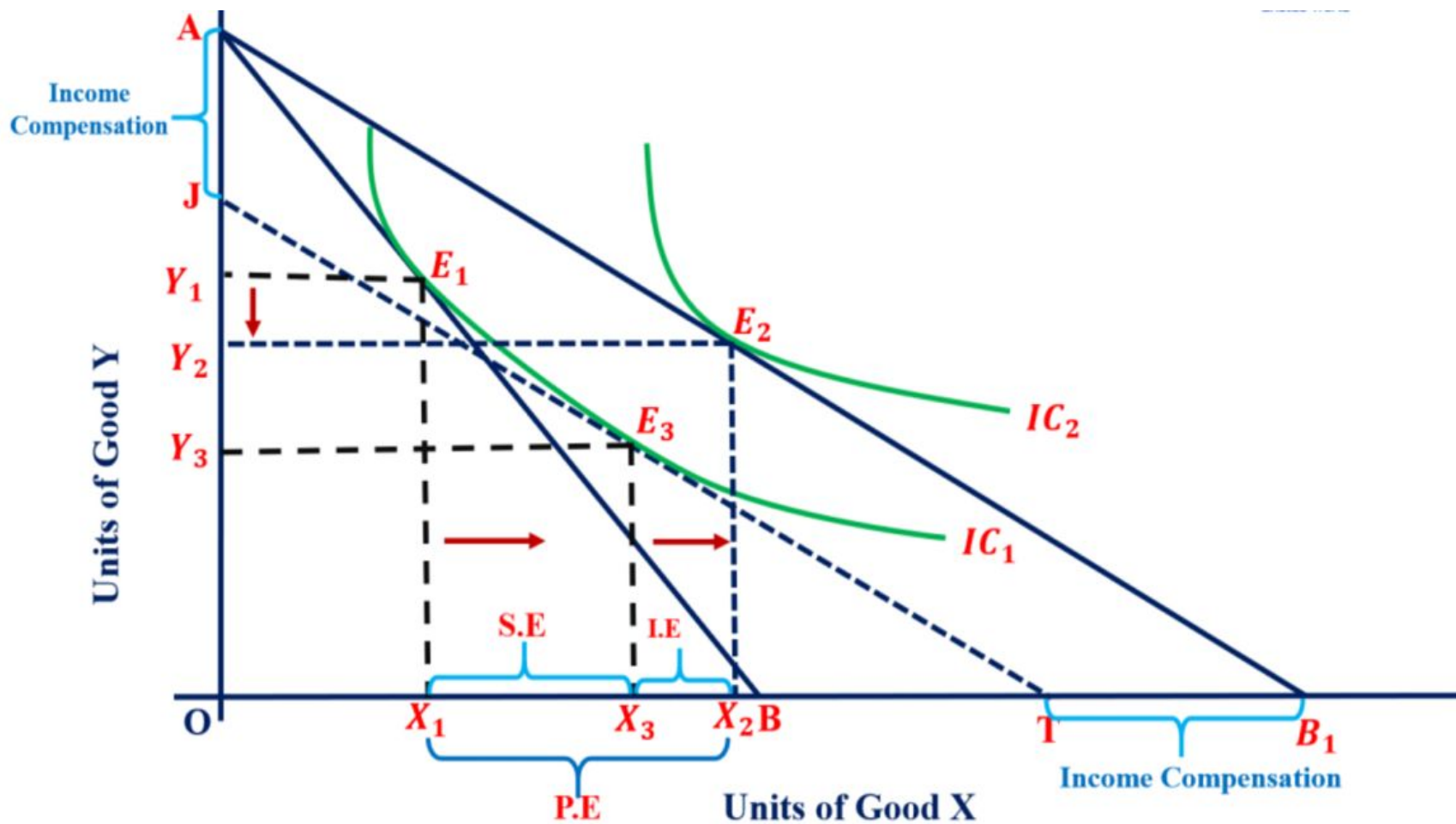
Substitution

- Substitution effect: Substitution effect occurs when a change in the relative prices of goods, makes a rational consumer induce to substitute a relatively cheaper commodity for the dearer one.

Decomposition of PE into SE and IE

- **Hicksian Approach:** Sir J.R. Hick, a British New Keynesian economist's *Value and Capital* published in 1939 to distinction between the substitution effect and the income effect in the case of normal goods.
- Income and Substitutions Effects of Decrease in Price

$$PE = SE + IE$$



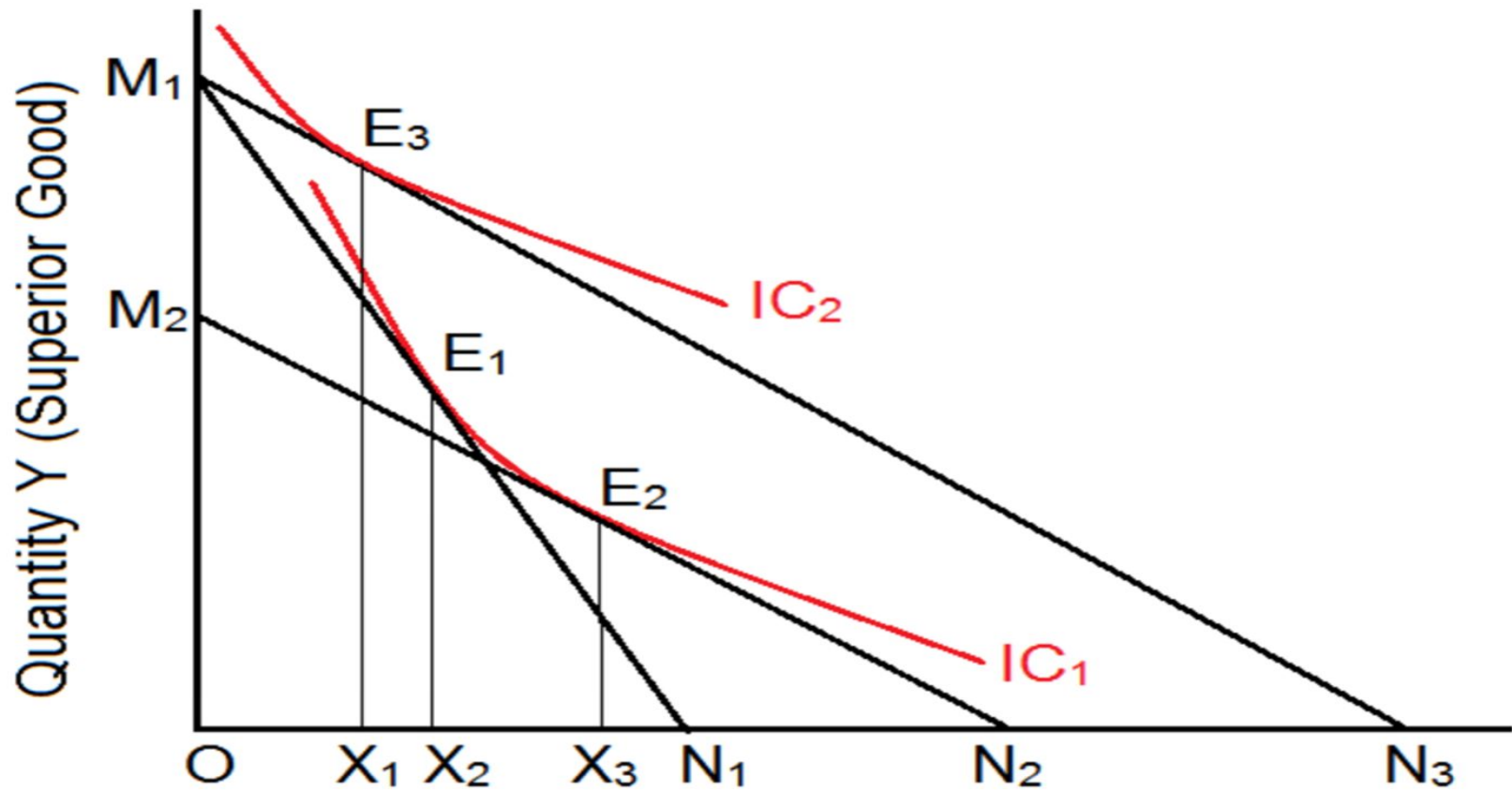
Explanation of Figure

- The Hicksian method of measuring the income effect involves reducing the consumer's income (by way of taxation) so that the consumer returns to the original indifference curve IC_1 in accordance with the new price ratio. Hicks calls it the income compensation approach. It is the same as the income adjustment approach. This is done by drawing an imaginary budget line JT parallel to AB_1 and tangential to the indifference curve IC_1 . It means that when a consumer's income is taxed away to the extent of the real income effect, the budget line AB_1 shifts downwards to JT . The budget line JT is tangential to the indifference curve IC_1 at point E_3 .

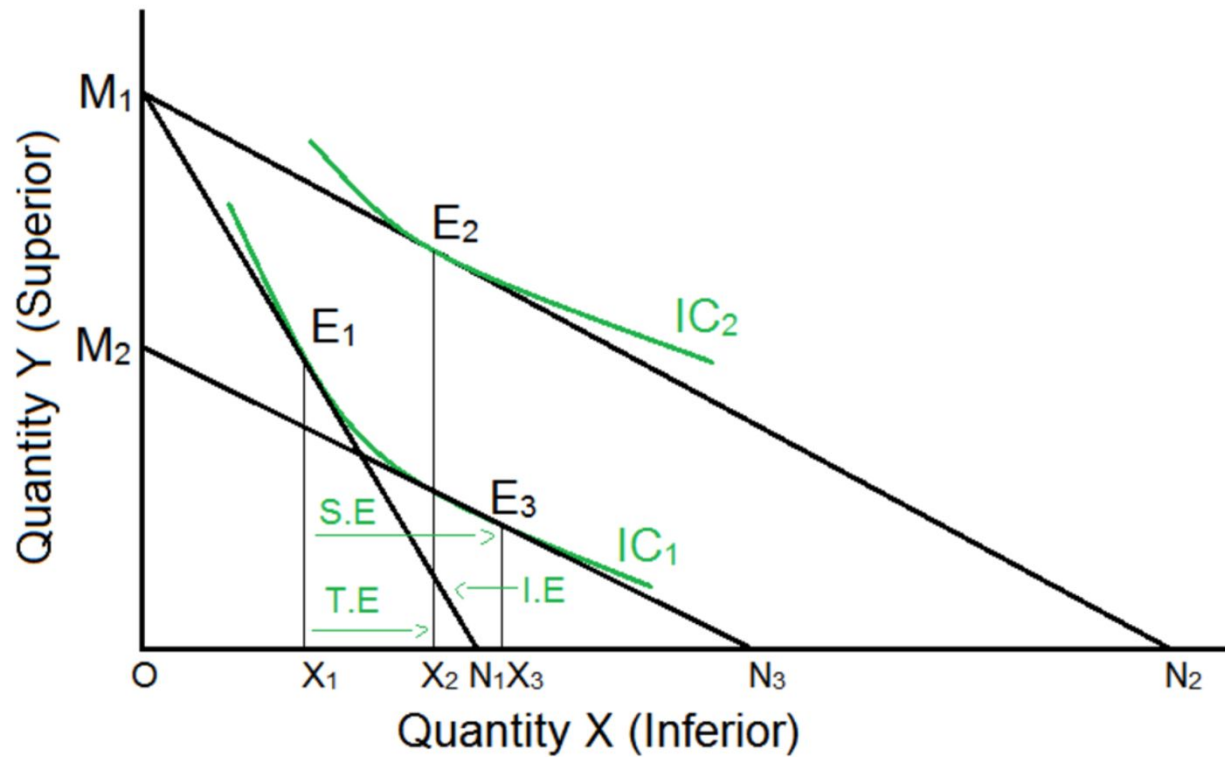
Explanation of figure

Point E3 represents the equilibrium of the consumer at the new price ratio of the goods X and Y, after elimination of the real income effect. It means that, after income adjustment, the consumer will move from point E2 to E3. The consumer's movement from point E2 to E3 means a decrease by X_2X_3 in the quantity of good X demanded. This change in quantity of X demanded results from a decrease in the consumer's real income due to taxation. Therefore, X_2X_3 is the income effect.

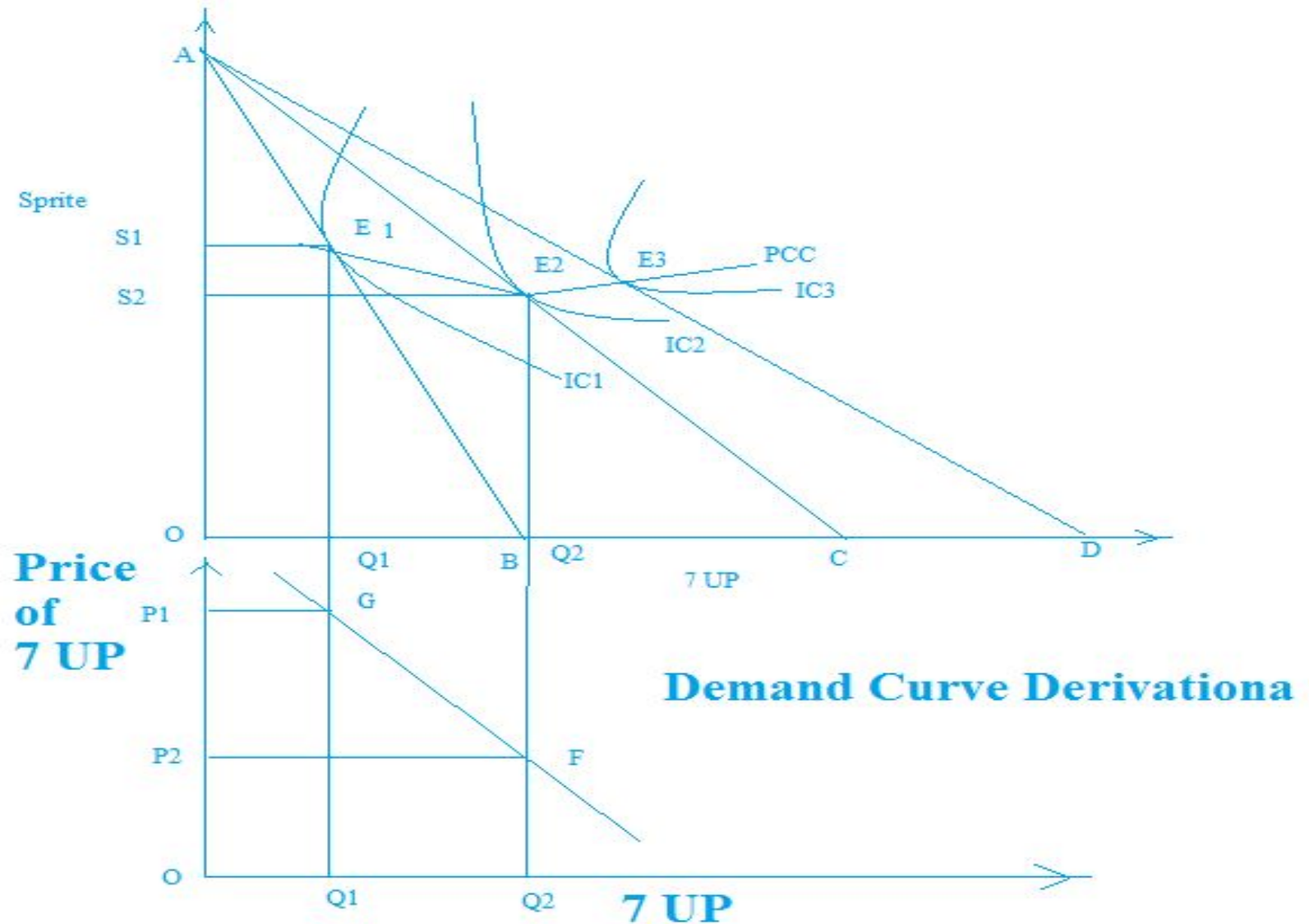
Giffen Goods Case



Inferior Goods Case



Demand curve derivation



Criticism of Indifference Curve

1. **Two Commodity Model:**
2. **Wrong Assumption of Rational Consumer:**
{(Assumption: Rational consumer): due to limited information source consumer does not act rationally}
3. **No newness:** Prof. Robertson(introspective cardinalism to introspective ordinalism, substitute marginal utility (MU)by marginal rate of substitution (MRS)
4. **Assumption based on No change in Income, preference and habit:** but in reality all this change.
5. **IC Approach cannot explain about uncertainty and risk:**
6. **Unrealistic Assumption of perfect competition:**

Difference between Cardinal and Ordinal approach

Cardinal utility approach	Ordinal utility approach
1. Utility can be measured cardinally in terms of numbers	1. Utility only can be ranked whether it is higher or lower.
2. Marginal utility of money remains constant.	2. It does not assume marginal utility of money remains constant.
3. There is law of diminishing marginal utility.	3. There is diminishing marginal rate of substitution (MRS)
4. The consumer is in equilibrium when $MU_X/P_X = MU_Y/P_Y = MU_m$	4. The consumer is in equilibrium when budget line becomes tangent to IC and IC is convex towards the origin at the point of tangency.
5. There is no classification of good.	5. There is classification of goods like superior, inferior, Giffen etc.
6. There is no analysis of income effect, price effect and substitution effect.	6. Price effect, income effect and substitution effect are analyzed.
7. Based on many unrealistic assumptions.	7. Based on few realistic assumptions.

Why ordinal approach is superior than cardinal approach?

1. There is no analysis of P.E. S.E. and I.E. in cardinal approach but the ordinal approach does it.
2. Cardinal approach is based on many unrealistic assumptions like cardinal measurement of utility, MUm remains constant, utility is independent etc. Where as ordinal approach is based on some realistic assumptions like ordinal measurement of utility, non-satiety nature of consumer and application of DMRS.
3. Cardinal utility analysis deals with only one commodity. On the other hand. Ordinal utility deals with at least two commodities at a time.