Module 1: Indifference Curve and its Properties, Budget Line, Price Consumption Curve and Income Consumption Curve

Indifference Curve Approach

Indifference curve approach is a popular theory of consumer's demand. J.R. Hicks and R.G.D. Allen put forward the indifference curve approach based on the notion of ordinal utility to explain consumer's behaviour. According to indifference curve approach utility is a subjective matter or psychic entity. Therefore, utility cannot be measured in terms of quantitative units. Indifference cure approach is based on ordinal utility approach. Ordinal utility implies that consumer is capable of simply comparing the different levels of satisfaction or utility. In other words, consumer is capable of judging whether the satisfaction obtained from a good or combination of goods is equal to, lower than or higher than another. Therefore, consumer is able to arrange various combination of goods in a scale of preference.

A consumption bundle or bundle is a combination of various goods that are available. For example, a consumption bundle might be 2 apples, 1 banana and 5 mangoes. We would write this as (2,1,5).

Therefore, a consumption bundle is defined by a vector:

$x = (x_1, x_2, \dots\dots\dots\dots\dots, x_n)$

Where $x_i = i = 1,2, \ldots\ldots\ldots, n$, is the amount of i^{th} good in the bundle. Each x_i is non-negative. The consumer can consume only zero or a positive quantity of each good.

Here we consider a commodity bundle consists of two commodities. Let us assume that there be two consumption bundles A and B e.g. $A = (x_1^A, x_2^A)$, $B = (x_1^B, x_2^B)$. Here in ordinal utility approach, consumer prefers some commodity bundles to others. Therefore, consumer can rank the commodity bundles in order of preference and choses the one which is highest in ranking.

We assume that consumer is able to rank his/her preferences consistently. Thus, consumer can make such statements such as, 'I prefer consumption bundle A to B, or, 'I am indifferent between A and B. Therefore, consumer can indicate his preference or indifference between any pair of commodity bundles. Thus, the basis of indifference curve analysis of demand is the preference indifference hypothesis.

A preference ordering is a scheme that enables the consumers to rank different bundles of goods in terms of their desirability or order of preference. Since different consumers generally will have different system of preferences, we assume that all preference ordering of the consumers possess certain properties in common

Assumptions of Consumer's Preference Ordering

1. Completeness:

Preferences are assumed to be complete. In other words, consumers can compare and rank all possible baskets. Thus, for any two market baskets A and B, a consumer will prefer A to B, will prefer B to A or will be indifferent between the two. By indifferent we mean that a per-son will be equally satisfied with either basket. Note that these preferences ignore costs. A consumer might prefer steak to hamburger but buy hamburger because it is cheaper.

2. Transitivity:

Preferences are transitive. Transitivity means that if a consumer prefers basket A to basket B and basket B to basket C, then the consumer also prefers A to C. For example, if a Porsche is preferred to a Cadillac and a Cadillac to a Chevrolet, then a Porsche is also preferred to a Chevrolet. Transitivity is normally regarded as necessary for consumer consistency.

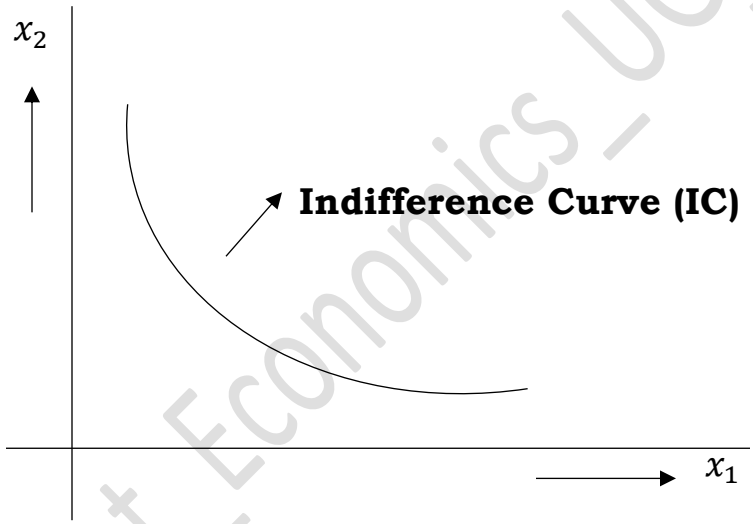
3. More is better than less:

Goods are assumed to be desirable—i.e., to be good. Consequently, consumers always prefer more of any good to less. In addition, consumers are never satisfied or satiated; more is always better, even if just a little better. This assumption is made for pedagogic reasons; namely, it simplifies the graphical analysis. Of course, some goods, such as air pollution, may be undesirable, and consumers will always

prefer less. We ignore these "bads" in the context of our immediate discussion of consumer choice because most consumers would not choose to purchase them.

Indifference curve

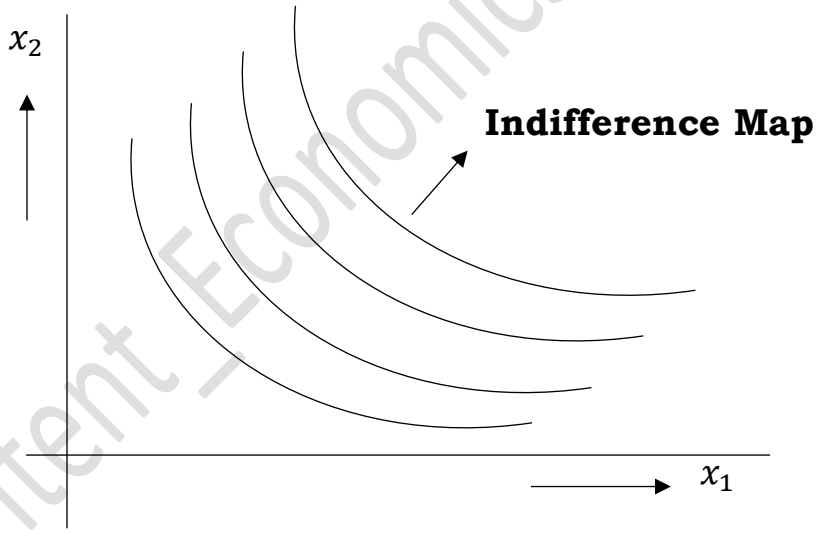
An indifference curve shows combinations of two goods x_1 and x_2 from which the consumer gets same level of satisfaction or utility.



If both the goods give positive satisfaction to the consumer, then as the number of x_1 increases, some of the other good x_2 must be taken away from him in order that he remains indifferent. Thus, as we move along the indifference curve, the quantity of one good rises and the other falls. This implies that indifference curves are negative sloped.

Indifference Map

A complete description of consumer's tastes and preferences can be represented by an indifference map which consists of set of indifference curves. Because a two dimensional space contains infinite number of points, each representing a combination of two goods x_1 and x_2. Therefore, there will be an infinite number of indifference curves each passing through combinations of goods that are equally desirable to the consumers.



We consider the utility function $\boldsymbol{u = u(x_1, x_2)}$.

Along an indifference curve change in total utility is zero as utility remains constant. Taking total differential of the utility function we get

$$dU = 0 = \frac{\partial U}{\partial x_1}dx_1 + \frac{\partial U}{\partial x_2}dx_2$$

$$\therefore\ U_1 dx_1 + U_2 dx_2 = 0,\ \frac{\partial U}{\partial x_i} = U_i$$

Where $\frac{\partial U}{\partial x_1} = U_1 \Rightarrow$ Marginal Utility of x_1 and $\frac{\partial U}{\partial x_2} = U_2 \Rightarrow$ Marginal utility of x_2.

$\therefore \frac{dx_2}{dx_1} = -\frac{U_1}{U_2} \Rightarrow$ Indifference curves are negatively sloped as $\boldsymbol{U_1, U_1 > 0} \Rightarrow \frac{dx_2}{dx_1} < 0$.

$$\therefore -\frac{\boldsymbol{dx_2}}{\boldsymbol{dx_1}} = \frac{\boldsymbol{U_1}}{\boldsymbol{U_2}} = \frac{\boldsymbol{MU_1}}{\boldsymbol{MU_2}} = \boldsymbol{Marginal\ Rate\ of\ Substitution}\ (\boldsymbol{MRS})$$

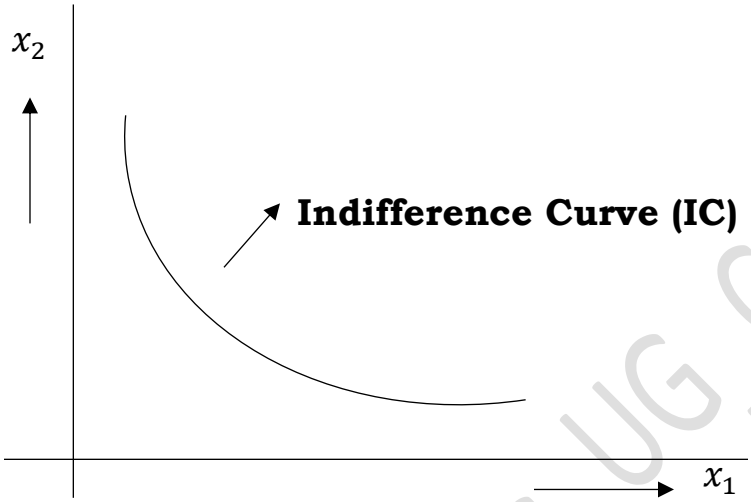
This gives the absolute value of the slope of an indifference curve. This is called the marginal rate of substitution of X_1 for X_2. $\boldsymbol{MRS_{x_1\ for\ x_2}}$ is defined as the rate at which the consumer is willing to substitute X_1 for X_2 so as to remain indifferent.

Properties of Indifference Curves

1. **<u>Indifference curves are negatively sloped</u>**

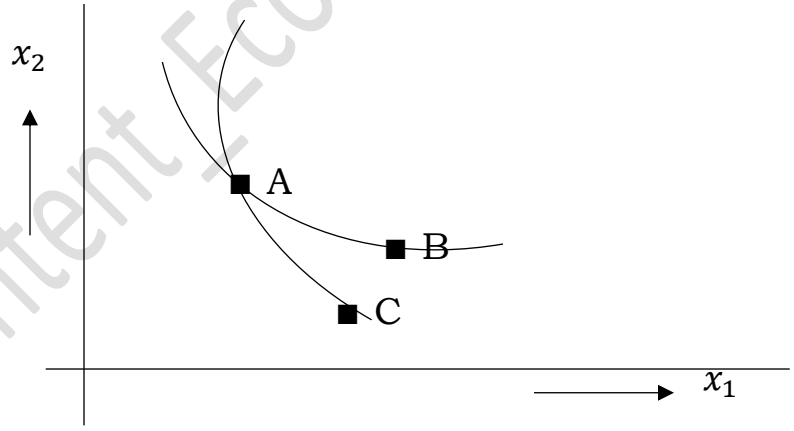
As the number of one good x_1 increases, some of the other good x_2 must be taken away from him in order that he remains indifferent. Thus, as we move along the indifference curve, the quantity of one

good rises and the other falls. This implies that indifference curves are negative sloped.



2. <u>Indifference curves cannot intersect each other</u>

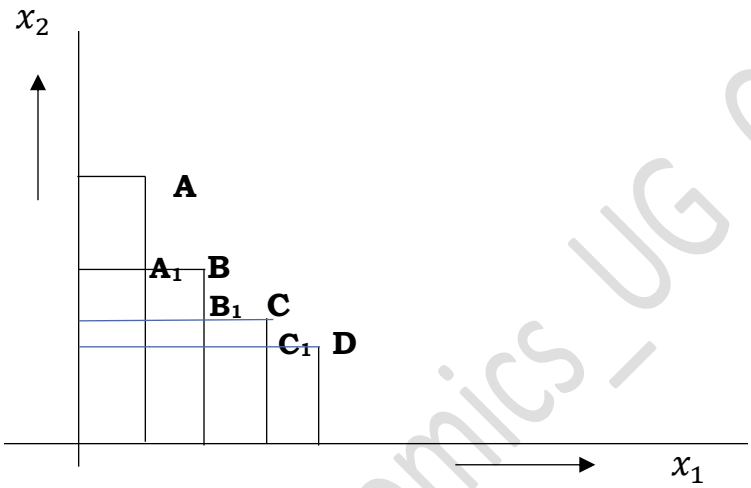
No two indifference curves can intersect each other because if they do, the consumer's preference pattern would be inconsistent.



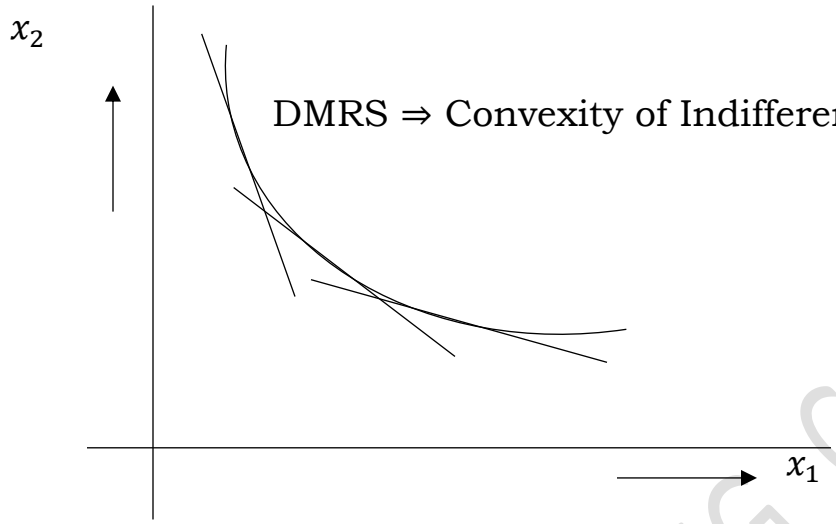
Point B in the above figure contains more of both goods (x_1 and x_2) than does C and so B is preferred to C. Again, since B and A both lie on the same indifference curve the consumer is indifferent between A and B. by the same argument, the consumer is also indifferent

between A and C. As a result, the consumer is indifferent between B and C (via A). This contradicts the initial argument that B is preferred to C.

3. Indifference curves are convex to the origin

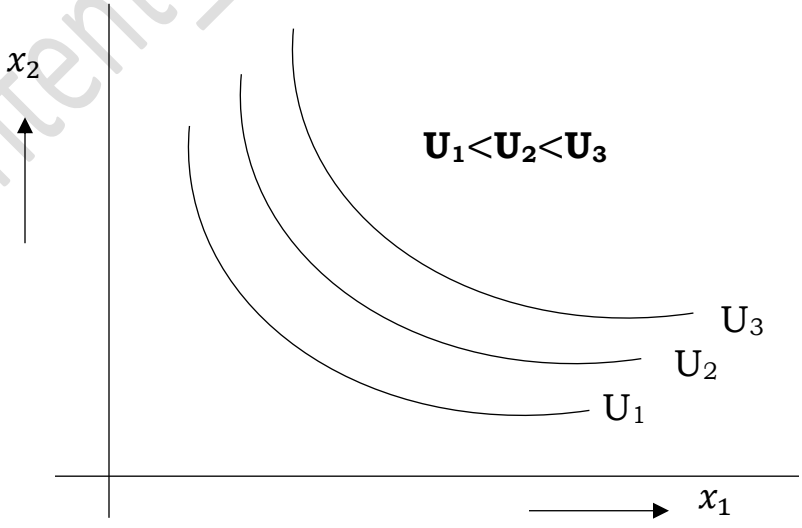


In the above diagram, we observe that, for the same amount of change in good x_1, the consumer is willing to sacrifice less and less of good x_2 ($AA_1 > BB_1 > CC_1$). This is because as the consumer gets more of good x_1, its significance to him decreases. This is summed up by the assumption of diminishing marginal rate of substitution (DMRS). Geometrically, this implies that the absolute slope of the indifference curve (i.e. MRS) decreases as we move along it. Thus, the indifference curve becomes convex to the origin.



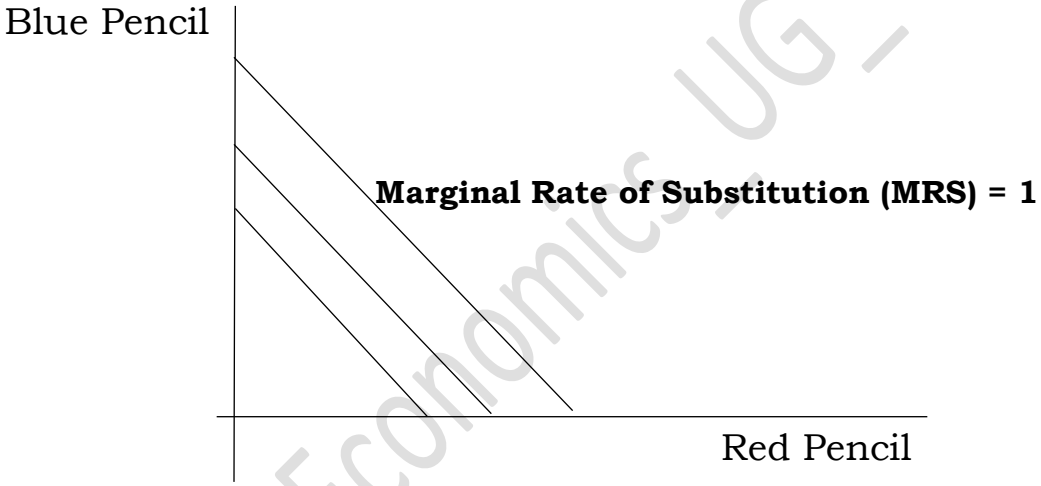
4. <u>The higher the indifference curve the greater is the level of utility</u>

This is because a higher indifference curve will consist of points which contain more of at least one good than a lower indifference curve and hence such points indicate a higher level of utility. This is clearly see in the figure below.



Perfect Substitutes:

When two goods are perfect substitutes, they are completely interchangeable. The consumer is always willing to exchange/substitute one good for the other at a constant rate. Thus the MRS remains constant. The indifference curve for perfect substitute is a straight line.



The above figure shows consumer's preferences for red pencil and blue pencil. These two goods are perfect substitutes because the consumer is indifferent between having a red pencil or blue pencil. In this case, the MRS of red pencil for blue pencil is 1. Consumer is always willing to trade one red pencil for one blue pencil.

Example:

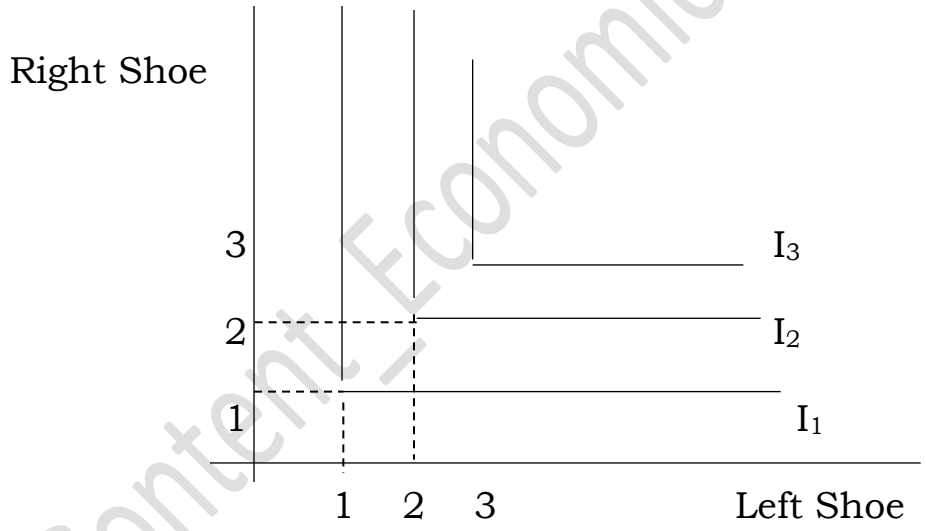
Utility function: U (X_1, X_2) = X_1 + X_2. Here the consumer wants to sacrifice one unit of X_2 for one unit of X_1.

If the consumer is willing to substitute two units of X_2 for one unit of X_1, then the utility function will be $U(X_1, X_2) = 2X_1 + X_2$: MRS = 2.

General form of the utility function will be: $U(X_1, X_2) = aX_1 + bX_2$

Perfect Complements:

When two goods must be used together in a fixed proportion as the case of right and left shoes, they are said to be perfect complements. As shown in figure below an indifference curve for perfect complements will be given by line segments having 90^0 angles in them.



On indifference curve I_1 the consumer has one unit of both shoes. If he receives two more left shoes and no more right shoes he would still remain on indifference curve (IC) I_1. Any addition to the stock of left shoe without any increase in the number of right shoe would not

add to utility. General form of the utility functional form of the utility function is $U = \min(x_1, x_2)$.

Budget Constraint

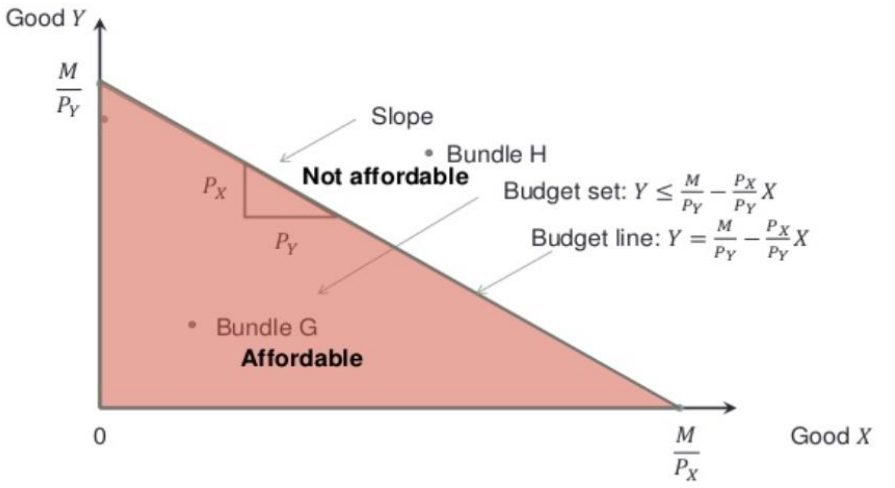
Individual's budget constraint is a limit that a person's income places on the combinations of goods that a consumer can buy. The budget constraint that consumer faces as a result of his limited incomes.

To see how a budget constraint limits a consumer's choices, let us consider a situation in which a consumer has a fixed money income M. he purchases two commodities X and Y. the prices of X and Y are dented by P_x and P_Y respectively. Then total expenditure on a bundle (X, Y) will be $P_X.X + P_Y.Y$. this cannot exceed consumer's income M. therefore $P_X.X + P_Y.Y \leq M$. This is called budget constraint.

If the consumer spends his entire income on the two goods X and Y, then

$$P_X.X + P_Y.Y = M$$

This is called equation of the budget line. The budget line indicates all combinations of X and Y for which total amount of money spent is equal to income.



For example, in the above figure, if X = 0, no X is being purchased and Y is being bought. The maximum amount of Y that can be purchased is $\frac{M}{P_Y}$. On the other hand, if Y = 0, no Y is being purchased and X is being bought. The maximum amount of X can be purchased is $\frac{M}{P_X}$.

The feasible set or affordable set of commodity bundles then consists of all points in the shaded area including the boundary points in the above figure.

Consumer's Equilibrium

Given preferences and budget constraints, we can now determine how individual consumers chose how much of each good to buy. Consumers choose commodities in such a way to maximize the satisfaction they can achieve, given the limited budget available to them.

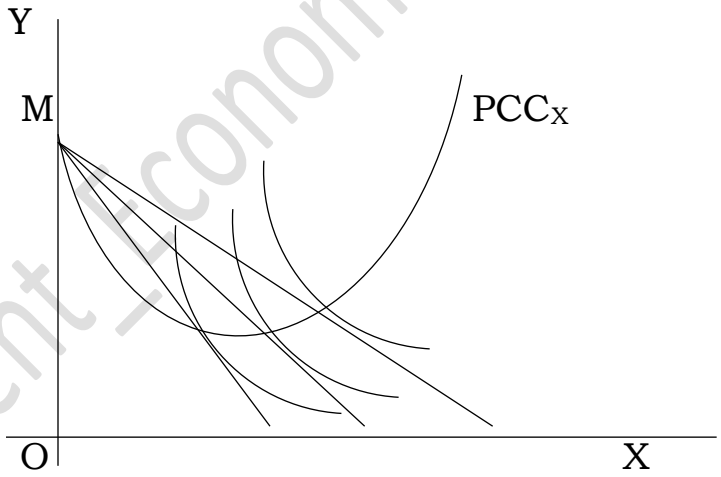
The maximizing commodity bundle must satisfy two conditions:

(i) It must be located on the budget line.

(ii) It must give the consumer the most preferred combination of goods and services.

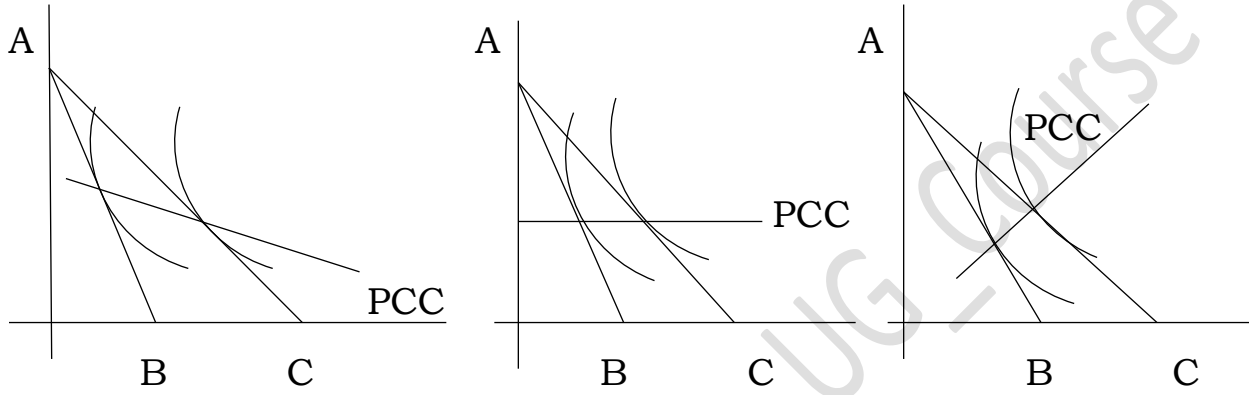
Price Consumption Curve

Price consumption curve is a locus of points in the commodity space showing the equilibrium commodity bundle resulting from a change in price of one commodity, the price of the other commodity and money income remaining unchanged.



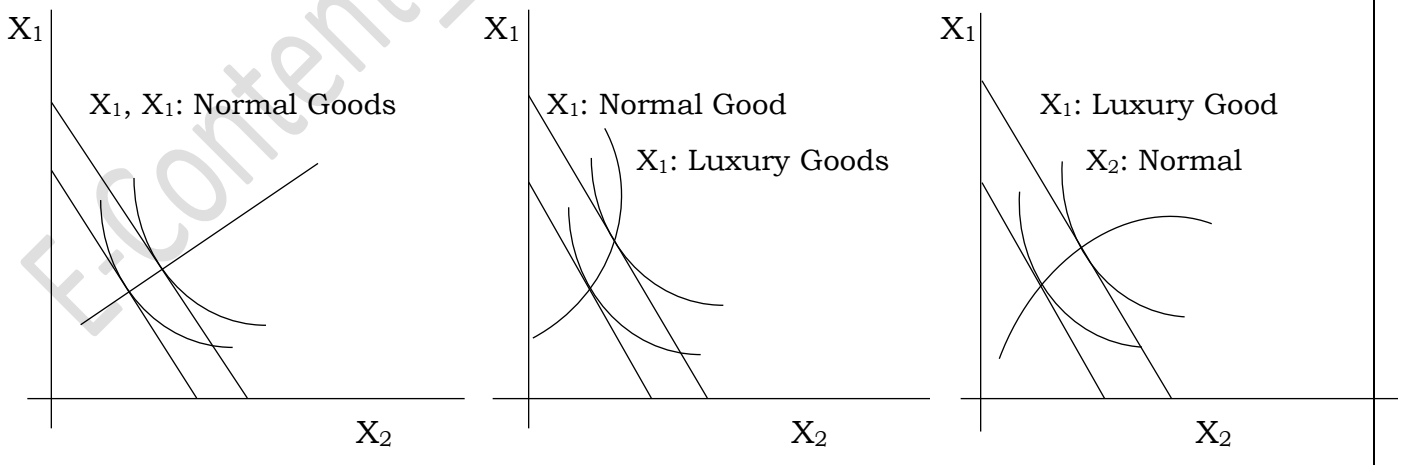
For each price of X, there is one budget line. As the price of X goes up, the budget line becomes steeper; with the price of X approaching infinity, the budget line becomes vertical and approaches OM. Then the consumer will buy only commodity Y. thus the PPC$_X$ starts from the vertical intercept M. initially it is negatively sloped and later on it may

be of different shapes depending on the own price elasticity of demand for X.



Income Consumption Curve (ICC)

ICC shows consumer's equilibrium at various levels of money income, prices, tastes and preferences remaining constant throughout. A good is said to be normal if the quantity consumed increases as income increases. Hence ICC is positively sloped the throughout its range when both goods are normal.



(a) **(b)** **(c)**

In panel (a) ICC is linear because demand for both goods changes in same proportion as income rises. Therefore, both goods are normal.

ICC will tilt towards the axis representing the commodity whose demand increases more than proportionately as income rises. Hence X_2 is a luxury good in panel (b) while X_1 is a luxury good in panel (c).