MICRO ECONOMICS

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CONSUMER'S EQUILIBRIUM

INTRODUCTION

A consumer is the main decision maker of consumption pattern.

A consumer is one who buys goods and services for satisfaction of wants. He/ She takes decisions with regards to the kind of goods to be purchased in order to satisfy his/ her wants.

The main objective is to get the maximum satisfaction from spending his/ her income on various goods and services.

The two main approaches to study consumers equilibrium are:-

1. Cardinal Utility Approach (or Marshall's Utility Analysis or Marginal Utility Analysis)

2. Ordinal Utility Approach (or indifference curve analysis)

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CARDINAL UTILITY APPROACH

People consume different goods and services in order to maximize the satisfaction level. However to do this it is necessary to determine quantum of satisfaction obtained from a particular commodity.

Under the cardinal utility approach the concept of utility is used to attain the consumer's equilibrium

CONCEPT OF UTILITY

Although the concept of 'taste' and 'satisfaction' are familiar for all of us, it is much more difficult to express these concepts in concrete terms.

For example, suppose you have just eaten an ice-cream and a chocolate. Can you tell how much are you satisfied from each of these items? Probably you can tell which item you liked more. But, it is very difficult to express "how much" you liked one over the other. It is evident, that we need a more quantitative measure of satisfaction. Due to this reason, economists developed the concept of utility.

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Meaning of Utility:

Utility refers to want satisfying power of a commodity. It is the satisfaction, actual or expected, derived from the consumption of a commodity. Utility differs from person- to-person, place-to-place and time-to-time. In the words of Prof. Hobson, "Utility is the ability of a good to satisfy a want".

In short, when a commodity is capable of satisfying human wants, we can conclude that the commodity has utility.

How to Measure Utility?

After understanding the meaning of utility, the next big question is: How to measure utility? According to classical economists, utility can be measured, in the same way, as weight or height is measured. For this, economists assumed that utility can be measured in cardinal (numerical) terms. By using cardinal measure of utility, it is possible to numerically estimate utility, which a person derives from consumption of goods and services. But, there was no standard unit for measuring utility. So, the economists derived an imaginary measure, known as 'Util'.

Utils are imaginary and psychological units which are used to measure satisfaction (utility) obtained from consumption of a certain quantity of a commodity.

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Example – Measurement of satisfaction in utils:

Suppose you have just eaten an ice-cream and a chocolate. You agree to assign 20 utils as utility derived from the ice-cream. Now the question is: how many utils be assigned to the chocolate? If you liked the chocolate less, then you may assign utils less than 20.

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One more way to measure utility:

Utils cannot be taken as a standard unit for measurement as it will vary from individual to individual. Hence, several economists including Marshall, suggested the measurement of utility in monetary terms. It means, utility can be measured in terms of money or price, which the consumer is willing to pay.

In the above example, suppose 1 util is assumed to be equal to Rs. 1. Now, an ice-cream will yield utility worth Rs. 20 (as 1 util = Rs. 1) and chocolate will give utility of Rs. 10. This utility of Rs. 20 from the ice-cream or f I0 from the chocolate is termed as value of utility in terms of money.

The advantage of using monetary values instead of utils is that it allows easy comparison between utility and price paid, since both are in the same units.

It must be noted that it is impossible to measure satisfaction of a person as it is inherent to the individual and differs greatly from person-to-person. Still, the concept of utility is very useful in explaining and understanding the behaviour of consumer.

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Total Utility (TU):

Total utility refers to the total satisfaction obtained from the consumption of all possible units of a commodity. It measures the total satisfaction obtained from consumption of all the units of that good. For example, if the 1st ice-cream gives you a satisfaction of 20 utils and 2nd one gives 16 utils, then TU from 2 ice-creams is 20 + 16 = 36 utils. If the 3rd ice-cream generates satisfaction of 10 utils, then TU from 3 ice-creams will be 20+ 16 + 10 = 46 utils.

$TU_n = U_1 + U_2 + U_3 + \ldots\ldots\ldots\ldots\ldots + U_n$

Where:

TU_n = Total utility from n units of a given commodity

$U_1, U_2, U_3, \ldots\ldots\ldots\ldots U_n$ = Utility from the 1st, 2nd, 3rd n^{th} unit

n = Number of units consumed

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Marginal Utility (MU):

Marginal utility is the additional utility derived from the consumption of one more unit of the given commodity. It is the utility derived from the last unit of a commodity purchased. As per given example, when 3rd ice-cream is consumed, TU increases from 36 utils to 46 utils. The additional 10 utils from the 3rd ice-cream is the MU.

In the words of Chapman, "Marginal utility is addition made to total utility by consuming one more unit of a commodity".

MU can be calculated as: $MU_n = TU_n - TU_{n-1}$

Where: MU_n = Marginal utility from n^{th} unit; TU_n = Total utility from n units;

TU_{n-1} = Total utility from n – 1 units; n = Number of units of consumption

MU of 3rd ice-cream will be: $MU_3 = TU_3 - TU_2 = 46 - 36 = 10$ utils

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Marginal Utility (MU):

One More way to Calculate MU

MU is the change in TU when one more unit is consumed. However, when change in units consumed is more than one, then MU can also be calculated as:

MU = Change in Total Utility/ Change in number of units = $\Delta TU/\Delta Q$

Total Utility is Summation of Marginal Utilities:

Total utility can also be calculated as the sum of marginal utilities from all units, i.e.
$TU_n = MU_1 + MU_2 + MU_3 + \ldots\ldots\ldots\ldots\ldots + MU_n$ or simply,
$TU = \sum MU$
The concepts of TU and MU can be better understood from the following schedule and diagram:

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TU and MU

Ice-creams Consumed	Marginal Utility (MU)	Total Utility (TU)
1	20	20
2	16	36
3	10	46
4	4	50
5	0	50
6	-6	44

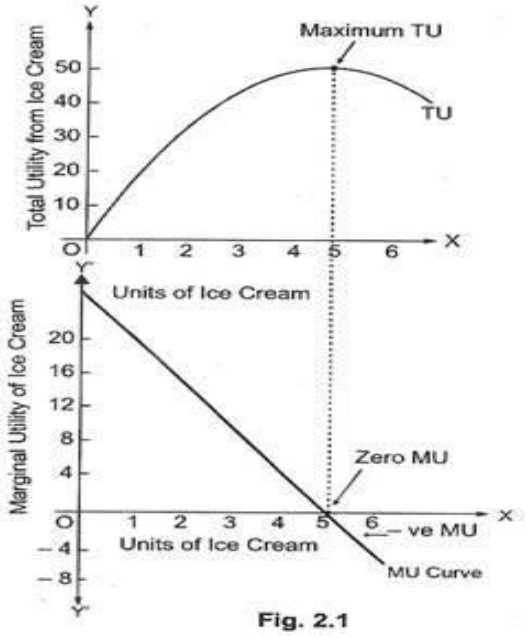

Fig. 2.1

In Fig. 2.1, units of ice-cream, are shown along the X-axis and TU and MU are measured along the Y-axis. MU is positive and TU is increasing till the 4th ice-cream. After consuming the 5th ice-cream, MU is zero and TU is maximum. This point is known as the point of satiety or the stage of maximum satisfaction. After consuming the 6th ice-cream, MU is negative (known as disutility) and total utility starts diminishing. Disutility is the opposite of utility. It refers to loss of satisfaction due to consumption of too much of a thing.

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Relationship between TU and MU:

1. TU increases with an increase in consumption of a commodity as long as MU is positive. In this phase, TU increases but a diminishing rate as MU from each successive unit tends to diminish.
2. When TU reaches its maximum, MU becomes zero. TU stops rising at this stage. This point is known as point of satiety.
3. When consumption is increased beyond the point of satiety, TU starts falling as MU becomes negative.

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RELATIONSHIP BETWEEN TOTAL UTILITY (TU) AND MARGINAL UTILITY (MU) :

When a consumer goes on to consume the units of a commodity continuously the marginal utility derived from the successive units of the commodity goes on to fall constantly while other factors are held constant. From the above statement regarding the consumer behavior the relationship between total utility (TU) and marginal utility (MU) is deducted as under: 1. MU is the rate of change of TU.When the MU decreases, TU increases at decreasing rate. 2. When MU becomes zero, TU is maximum. It is a saturation point. 3. When MU becomes negative, TU decline The standard quadratic form of the TU function is written as follows:

$TU = aQ - bQ2$

and $MU = dTU / dQ = a - 2bQ$

Slope of $MU = dMU/dQ$

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LAWS OF DIMINISHING MARGINAL UTILITY

A law of economics stating that as a person increases consumption of a product - while keeping consumption of other products constant - there is a decline in the marginal utility that person derives from consuming each additional unit of that product.

ASSUMPTIONS OF LAW OF DIMINISHING MARGINAL UTILITY

1. **Cardinal measurement of utility**: It is assumed that utility can be measured and a consumer can express his satisfaction in quantitative terms such as 1, 2, 3, etc.
2. **Monetary measurement of utility**: It is assumed that utility is measurable in monetary terms.

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ASSUMPTIONS OF LAW OF DIMINISHING MARGINAL UTILITY

3. **Consumption of reasonable quantity:** It is assumed that a reasonable quantity of the commodity is consumed.

4. **Continuous consumption:** It is assumed that consumption is a continuous process. For example, if one ice-cream is consumed in the morning and another in the evening, then the second ice-cream may provide equal or higher satisfaction as compared to the first one.

5. **No change in Quality:** Quality of the commodity consumed is assumed to be uniform. A second cup of ice-cream with nuts and toppings may give more satisfaction than the first one, if the first ice-cream was without nuts or toppings.

6. **Rational consumer:** The consumer is assumed to be rational who measures, calculates and compares the utilities of different commodities and aims at maximising total satisfaction.

7. **Independent utilities:** It is assumed that all the commodities consumed by a consumer are independent. It means, MU of one commodity has no relation with MU of another commodity. Further, it is also assumed that one person's utility is not affected by the utility of any other person.

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ASSUMPTIONS OF LAW OF DIMINISHING MARGINAL UTILITY

8. **MU of money remains constant:** As a consumer spends money on the commodity, he is left with lesser money to spend on other commodities.

9. **Fixed Income and prices:** It is assumed that income of the consumer and prices of the goods which the consumer wishes to purchase remain constant.

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Let us understand the law with the help of Table and Fig. :

Table : Law of Diminishing Marginal Utility

Units of Ice Cream	Total Utility (in utils)	Marginal Utility (in utils)
1	20	20
2	36	16
3	46	10
4	50	4
5	50	0 (Point of Satiety)
6	44	-6

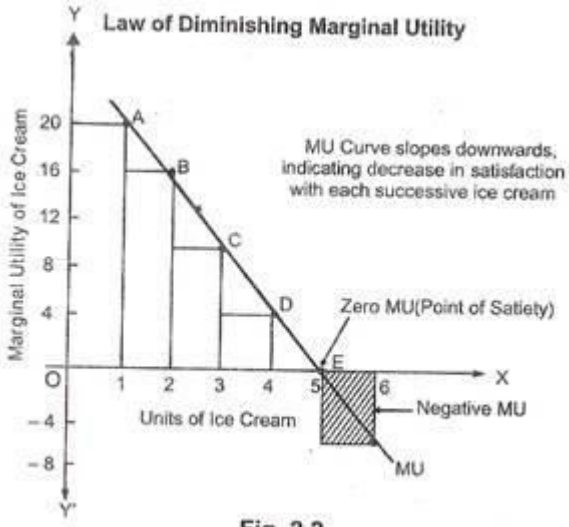

Fig. 2.2

In the diagram, units of ice-cream are shown along the X-axis and MU along the Y-axis. MU from each successive ice-cream is represented by points A, B, C, D and E. As seen, the rectangles (showing each level of satisfaction) become smaller and smaller with increase in consumption of ice-creams.

MU falls from 20 to 16 and then to 10 utils, when consumption is increased from 1st to 2nd and then to 3rd ice-cream. 5th ice-cream has no utility (MU= 0) and this is known as the 'Point of satiety'. When 6th ice-cream is consumed, MU becomes negative. MU curve slopes downwards showing that MU of successive units is falling.

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The term 'equilibrium' is frequently used in economic analysis. Equilibrium means a state of rest or a position of no change. It refers to a position of rest, which provides the maximum benefit or gain under a given situation. A consumer is said to be in equilibrium, when he does not intend to change his level of consumption, i.e., when he derives maximum satisfaction.

Consumer's Equilibrium refers to the situation when a consumer is having maximum satisfaction with limited income and has no tendency to change his way of existing expenditure. The consumer has to pay a price for each unit of the commodity. So, he cannot buy or consume unlimited quantity. As per the Law of DMU, utility derived from each successive unit goes on decreasing. At the same time, his income also decreases with purchase of more and more units of a commodity.

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So, a rational consumer aims to balance his expenditure in such a manner, so that he gets maximum satisfaction with minimum expenditure. When he does so, he is said to be in equilibrium. After reaching the point of equilibrium, there is no further incentive to make any change in the quantity of the commodity purchased.

It is assumed that the consumer knows the different goods on which his income can be spent and the utility that he is likely to get out of such consumption. It means that the consumer has perfect knowledge of the various choices available to him.

Consumer's equilibrium can be discussed under two different situations:

1. Consumer spends his entire income on a Single Commodity
2. Consumer spends his entire income on Two Commodities

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Consumer's Equilibrium in case of Single Commodity:

The Law of DMU can be used to explain consumer's equilibrium in case of a single commodity. Therefore, all the assumptions of Law of DMU are taken as assumptions of consumer's equilibrium in case of single commodity.

A consumer purchasing a single commodity will be at equilibrium, when he is buying such a quantity of that commodity, which gives him maximum satisfaction. The number of units to be consumed of the given commodity by a consumer depends on 2 factors:

1. Price of the given commodity;
2. Expected utility (Marginal utility) from each successive unit.

To determine the equilibrium point, consumer compares the price (or cost) of the given commodity with its utility (satisfaction or benefit). Being a rational consumer, he will be at equilibrium when marginal utility is equal to price paid for the commodity. We know, marginal utility is expressed in utils and price is expressed in terms of money However, marginal utility and price can be effectively compared only when both are stated in the same units. Therefore, marginal utility in utils is expressed in terms of money.

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Consumer's Equilibrium in case of Single Commodity:

Marginal Utility in terms of Money = Marginal Utility in utils/ Marginal Utility of one rupee (MU_M)

MU of one rupee is the extra utility obtained when an additional rupee is spent on other goods. As utility is a subjective concept and differs from person to person, it is assumed that a consumer himself defines the MU of one rupee, in terms of satisfaction from bundle of goods.

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Equilibrium Condition:

Consumer in consumption of single commodity (say, x) will be at equilibrium when:

Marginal Utility (MU_x) is equal to Price (P_x) paid for the commodity; i.e. $MU_X = P_x$

i. If $MU_X > P_x$, then consumer is not at equilibrium and he goes on buying because benefit is greater than cost. As he buys more, MU falls because of operation of the law of diminishing marginal utility. When MU becomes equal to price, consumer gets the maximum benefits and is in equilibrium.

ii. Similarly, when $MU_X < P_x$, then also consumer is not at equilibrium as he will have to reduce consumption of commodity x to raise his total satisfaction till MU becomes equal to price.

Note:

In addition to condition of "MU = Price", one more condition is needed to attain consumer's equilibrium: "MU falls as consumption increases". However, this second condition is always implied because of operation of Law of DMU. So, a consumer in consumption of single commodity will be at equilibrium when MU = Price.

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Equilibrium Condition:

Let us now determine the consumer's equilibrium if the consumer spends his entire income on single commodity. Suppose, the consumer wants to buy a good (say, x), which is priced at Rs. 10 per unit. Further suppose that marginal utility derived from each successive unit (in utils and in is determined and is given in Table 2.3 (For sake of simplicity, it is assumed that 1 util = Rs. 1, i.e. MU_M = Rs. 1).

Table 2.3: Consumer's Equilibrium in case of Single Commodity

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Table 2.3: Consumer's Equilibrium in case of Single Commodity

Units of X	Price (P_x) (Rs.)	Marginal utility (utils)	Marginal utility in Rs. (MU_x) 1 util =Rs. 1	Difference MU_x and P_x	Remarks
1	10	20	20/1 = 20	20-10= 10	$MU_x > P_x$ so
2	10	16	16/1 = 16	16-10= 6	consumer will increase the consumption
3	10	10	10/1 = 10	10-10= 0	Consumer's Equilibrium ($MU_x=P_x$)
4	10	4	4/1 = 4	4-10= -6	$MU_x < P_x$, so
5	10	0	0/1 = 0	0-10=-10	consumer will decrease the consumption
6	10	-6	– 6/1 = -6	-6-10=-16	

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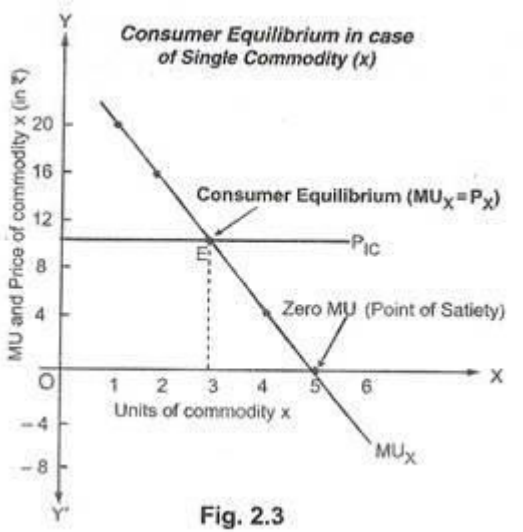

Fig. 2.3

In Fig. 2.3, MU_X curve slopes downwards, indicating that the marginal utility falls with successive consumption of commodity x due to operation of Law of DMU. Price (P_x) is a horizontal and straight price line as price is fixed at Rs. 10 per unit. From the given schedule and diagram, it is clear that the consumer will be at equilibrium at point 'E', when he consumes 3 units of commodity x, because at point E, $MU_X = P_x$

i. He will not consume 4 units of x as MU of Rs. 4 is less than price paid of Rs. 10.

ii. Similarly, he will not consume 2 units of x as MU of Rs. 16 is more than the price paid.

So, it can be concluded that a consumer in consumption of single commodity (say, x) will be at equilibrium when marginal utility from the commodity (MUJ is equal to price (PJ paid for the commodity.

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Consumer's Equilibrium in case of Two Commodities:

The Law of DMU applies in case of either one commodity or one use of a commodity. However, in real life, a consumer normally consumes more than one commodity. In such a situation, 'Law of Equi-Marginal Utility' helps in optimum allocation of his income.

Law of Equi-marginal utility is also known as:

(i) Law of Substitution;

(ii) Law of maximum satisfaction;

(iii) Gossen's Second Law.

As law of Equi-marginal utility is based on Law of DMU, all assumptions of the latter also apply to the former. Let us now discuss equilibrium of consumer by taking two goods: 'x' and 'y'. The same analysis can be extended for any number of goods.

In case of consumer equilibrium under single commodity, we assumed that the entire income was spent on a single commodity. Now, consumer wants to allocate his money income between the two goods to attain the equilibrium position.

According to the law of Equi-marginal utility, a consumer gets maximum satisfaction, when ratios of MU of two commodities and their respective prices are equal and MU falls as consumption increases. It means, there are two necessary conditions to attain Consumer's Equilibrium in case of Two Commodities:

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(i) Marginal Utility (MU) of last rupee spent on each commodity is same:

i. We know, a consumer in consumption of single commodity (say, x) is at equilibrium when $MU_x/P_x = MU_M$

(ii) Similarly, consumer consuming another commodity (say, y) will be at equilibrium when $MU_Y/P_Y = MU_M$

Equating 1 and 2, we get: $MU_X/P_X = MU_Y/P_Y = MU_M$

As marginal utility of money (MU_M) is assumed to be constant, the above equilibrium condition can be restated as:

$MU_X = MU_Y/P_Y$ or $MU_X/MU_Y = P_X/P_Y$

What happens when MU_X/P_X is Not Equal to MU_Y/P_Y

(i) Suppose, $MU_X/P_X > MU_Y/P_Y$. In this case, the consumer is getting more marginal utility per rupee in case of good X as compared to Y. Therefore, he will buy more of X and less of Y. This will lead to fall in MU_X and rise in MU_Y. The consumer will continue to buy more of X till $MU_X/P_X = MU_Y/P_Y$

(ii) When $MU_X/P_X < MU_Y/P_Y$, the consumer is getting more marginal utility per rupee in case of good Y as compared to X. Therefore, he will buy more of Y and less of X. This will lead fall in MU_Y and rise in MU_X. The consumer will continue to buy more of Y till $MU_X/P_X = MU_Y/P_Y$.

It brings us to a conclusion that $MU_X/P_X = MU_Y/P_Y$ is a necessary condition to attain Consumer's Equilibrium.

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(ii) MU falls as consumption increases:

The second condition needed to attain consumer's equilibrium is that MU of a commodity must fall as more of it is consumed. If MU does not fall as consumption increases, the consumer will end up buying only one good which is unrealistic and consumer will never reach the equilibrium position.

Finally, it can be concluded that a consumer in consumption of two commodities will be at equilibrium when he spends his limited income in such a way that the ratios of marginal utilities of two commodities and their respective prices are equal and MU falls as consumption increases.

Explanation with the help of an Example:

Let us now discuss the law of equi-marginal utility with the help of a numerical example. Suppose, total money income of the consumer is Rs. 5, which he wishes to spend on two commodities: 'x' and 'y'. Both these commodities are priced at Rs. 1 per unit. So, consumer can buy maximum 5 units of 'x' or 5 units of 'y'. In Table 2.4, we have shown the marginal utility which the consumer derives from various units of 'x' and 'y'.

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Table 2.4: Consumer's Equilibrium in case of Two Commodities

Units	MU of commodity 'x' (in utils)	MU of commodity 'y' (in utils)
1	20	16
2	14	12
3	12	8
4	7	5
5	5	3

From Table 2.4, it is obvious that the consumer will spend the first rupee on commodity 'x', which will provide him utility of 20 utils. The second rupee will be spent on commodity 'y' to get utility of 16 utils. To reach the equilibrium, consumer should purchase that combination of both the goods, when:

(i) MU of last rupee spent on each commodity is same; and

(ii) MU falls as consumption increases.

It happens when consumer buys 3 units of 'x' and 2 units of 'y' because:

i. MU from last rupee (i.e. 5^{th} rupee) spent on commodity y gives the same satisfaction of 12 utils as given by last rupee (i.e. 4^{th} rupee) spent on commodity x; and

ii. MU of each commodity falls as consumption increases.

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The total satisfaction of 74 utils will be obtained when consumer buys 3 units of 'x' and 2 units of 'y'. It reflects the state of consumer's equilibrium. If the consumer spends his income in any other order, total satisfaction will be less than 74 utils.

For Practical Problems of 'Consumer's Equilibrium in case of Two Commodities', refer Example 8 (Section 2.9) and 2 Unsolved Problems given in the Exercise.

Limitation of Utility Analysis:

In the utility analysis, it is assumed that utility is cardinally measurable, i.e., it can be expressed in exact unit. However, utility is a feeling of mind and there cannot be a standard measure of what a person feels. So, utility cannot be expressed in figures. There are other limitations too. But, their discussion is beyond the scope.

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ORDINAL UTILITY APPROACH (INDIFFERENCE CURVE OR HICKSIAN ANALYSIS)

Modern economists disregarded the concept of 'cardinal measure of utility'. They were of the opinion that utility is a psychological phenomenon and it is next to impossible to measure the utility in absolute terms. According to them, a consumer can rank various combinations of goods and services in order of his preference. For example, if a consumer consumes two goods, Apples and Bananas, then he can indicate:

1. Whether he prefers apple over banana; or
2. Whether he prefers banana over apple; or
3. Whether he is indifferent between apples and bananas, i.e. both are equally preferable and both of them give him same level of satisfaction.

This approach does not use cardinal values like 1, 2, 3, 4, etc. Rather, it makes use of ordinal numbers like 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, etc. which can be used only for ranking. It means, if the consumer likes apple more than banana, then he will give 1^{st} rank to apple and 2^{nd} rank to banana. Such a method of ranking the preferences is known as 'ordinal utility approach'.

Before we proceed to determine the consumer's equilibrium through this approach, let us understand some useful concepts related to Indifference Curve Analysis.

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Meaning of Indifference Curve:

When a consumer consumes various goods and services, then there are some combinations, which give him exactly the same total satisfaction. The graphical representation of such combinations is termed as indifference curve.

Indifference curve refers to the graphical representation of various alternative combinations of bundles of two goods among which the consumer is indifferent. Alternately, indifference curve is a locus of points that show such combinations of two commodities which give the consumer same satisfaction. Let us understand this with the help of following indifference schedule, which shows all the combinations giving equal satisfaction to the consumer.

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Meaning of Indifference Curve:

Table 2.5: Indifference Schedule

Combination of Apples and Bananas	Apples (A)	Bananas (B)
P	1	15
Q	2	10
R	3	6
S	4	3
T	5	1

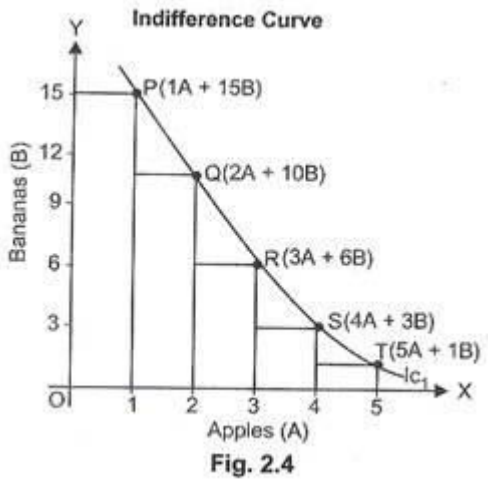

Fig. 2.4

As seen in the schedule, consumer is indifferent between five combinations of apple and banana. Combination 'P' (1A + 15B) gives the same utility as (2A + 10B), (3A + 6B) and so on. When these combinations are represented graphically and joined together, we get an indifference curve 'IC_1' as shown in Fig. 2.4.

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Meaning of Indifference Curve:

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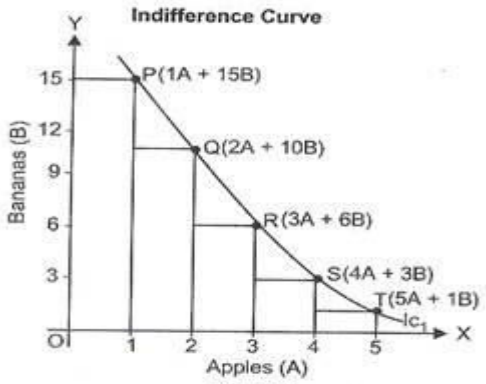

Fig. 2.4

In the diagram, apples are measured along the X-axis and bananas on the Y-axis. All points (P, Q, R, S and T) on the curve show different combinations of apples and bananas. These points are joined with the help of a smooth curve, known as indifference curve (IC_1). An indifference curve is the locus of all the points, representing different combinations, that are equally satisfactory to the consumer.

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Meaning of Indifference Curve:

Table 2.5: Indifference Schedule

Combination of Apples and Bananas	Apples (A)	Bananas (B)
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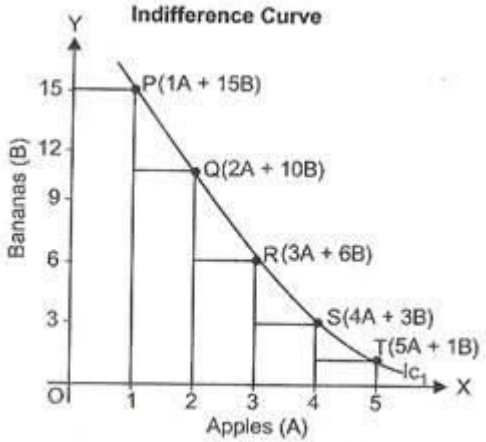

Fig. 2.4

Every point on IC_1, represents an equal amount of satisfaction to the consumer. So, the consumer is said to be indifferent between the combinations located on Indifference Curve 'IC_1'. The combinations P, Q, R, S and T give equal satisfaction to the consumer and therefore he is indifferent among them. These combinations are together known as 'Indifference Set'.

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CONSUMER'S EQUILIBRIUM

Monotonic Preferences:

Monotonic preference means that a rational consumer always prefers more of a commodity as it offers him a higher level of satisfaction. In simple words, monotonic preferences imply that as consumption increases total utility also increases. For instance, a consumer's preferences are monotonic only when between any two bundles, he prefers the bundle which has more of at least one of the goods and no less of the other good as compared to the other bundle.

Example: Consider 2 goods:

Apples (A) and Bananas (B).

(a) Suppose two different bundles are: 1^{st}: (10A, 10B); and 2^{nd}: (7A, 7B).

Consumer's preference of 1^{st} bundle as compared to 2^{nd} bundle will be called monotonic preference as 1^{st} bundle contains more of both apples and bananas.

(b) If 2 bundles are: 1^{st}: (1 OA, 7B); 2^{nd}: (9A, 7B).

Consumer's preference of 1^{st} bundle as compared to 2^{nd} bundle will be called monotonic preference as 1^{st} bundle contains more of apples, although bananas are same.

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Indifference Map:

Indifference Map refers to the family of indifference curves that represent consumer preferences over all the bundles of the two goods. An indifference curve represents all the combinations, which provide same level of satisfaction. However, every higher or lower level of satisfaction can be shown on different indifference curves. It means, infinite number of indifference curves can be drawn.

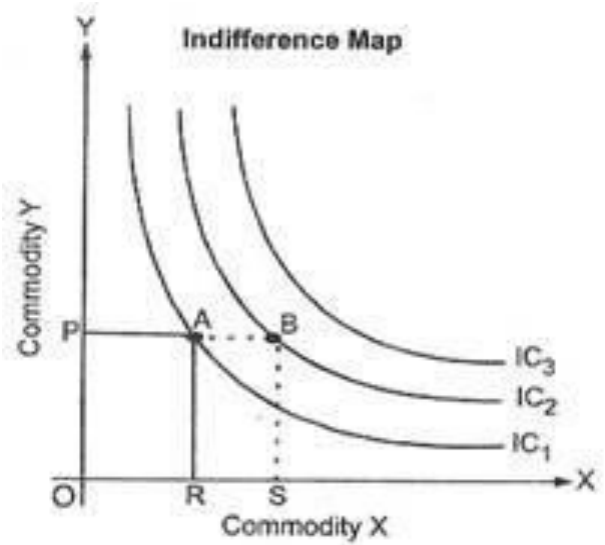

Fig. 2.5

In Fig. 2.5, IC_1 represents the lowest satisfaction, IC_2 shows satisfaction more than that of IC_1 and the highest level of satisfaction is depicted by indifference curve IC_3. However, each indifference curve shows the same level of satisfaction individually.

It must be noted that 'Higher Indifference curves represent higher levels of satisfaction' as higher indifference curve represents larger bundle of goods, which means more utility because of monotonic preference.

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Marginal Rate of Substitution (MRS):

MRS refers to the rate at which the commodities can be substituted with each other, so that total satisfaction of the consumer remains the same. For example, in the example of apples (A) and bananas (B), MRS of 'A' for 'B', will be number of units of 'B', that the consumer is willing to sacrifice for an additional unit of 'A', so as to maintain the same level of satisfaction.

MRS_{AB} = Units of Bananas (B) willing to Sacrifice / Units of Apples (A) willing to Gain

$MRS_{AB} = \Delta B/\Delta A$

MRS_{AB} is the rate at which a consumer is willing to give up Bananas for one more unit of Apple. It means, MRS measures the slope of indifference curve.

It must be noted that in mathematical terms, MRS should always be negative as numerator (units to be sacrificed) will always have negative value. However, for analysis, absolute value of MRS is always considered.

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The concept of MRS_{AB} is explained through Table 2.6 and Fig. 2.6

Table 2.6: MRS between Apple and Banana:

Combination	Apples (A)	Banana ADVERTISEMENTS: (B)	MRS^{AB}
P	1	15	–
Q	2	10	5B:1 A
R	3	6	4B:1A
S	4	3	3B:1A
T	5	1	2B:1 A

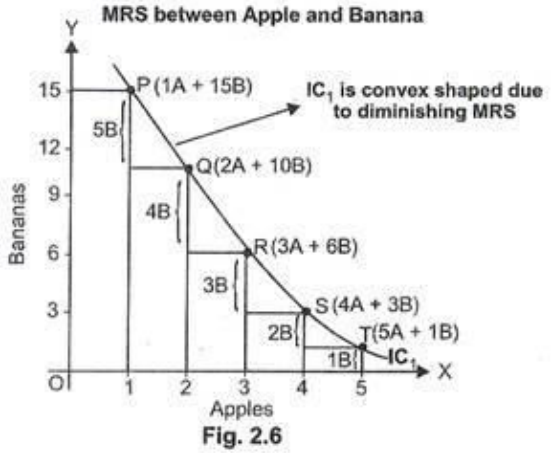

Fig. 2.6

As seen in the given schedule and diagram, when consumer moves from P to Q, he sacrifices 5 bananas for 1 apple. Thus, MRS_{AB} comes out to be 5:1. Similarly, from Q to R, MRS_{AB} is 4:1. In combination T, the sacrifice falls to 2 bananas for 1 apple. In other words, the MRS of apples for bananas is diminishing.

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Why MRS diminishes?

MRS falls because of the law of diminishing marginal utility. In the given example of apples and bananas, Combination 'P' has only 1 apple and, therefore, apple is relatively more important than bananas. Due to this, the consumer is willing to give up more bananas for an additional apple. But as he consumes more and more of apples, his marginal utility from apples keeps on declining. As a result, he is willing to give up less and less of bananas for each apple.

Assumptions of Indifference Curve

The various assumptions of indifference curve are:

1. Two commodities:

It is assumed that the consumer has a fixed amount of money, whole of which is to be spent on the two goods, given constant prices of both the goods.

2. Non Satiety:

It is assumed that the consumer has not reached the point of saturation. Consumer always prefer more of both commodities, i.e. he always tries to move to a higher indifference curve to get higher and higher satisfaction.

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Assumptions of Indifference Curve

3. Ordinal Utility:

Consumer can rank his preferences on the basis of the satisfaction from each bundle of goods.

4. Diminishing marginal rate of substitution:

Indifference curve analysis assumes diminishing marginal rate of substitution. Due to this assumption, an indifference curve is convex to the origin.

5. Rational Consumer:

The consumer is assumed to behave in a rational manner, i.e. he aims to maximize his total satisfaction.

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Properties of Indifference Curve:

1. Indifference curves are always convex to the origin:

An indifference curve is convex to the origin because of diminishing MRS. MRS declines continuously because of the law of diminishing marginal utility. As seen in Table 2.6, when the consumer consumes more and more of apples, his marginal utility from apples keeps on declining and he is willing to give up less and less of bananas for each apple. Therefore, indifference curves are convex to the origin (see Fig. 2.6). It must be noted that MRS indicates the slope of indifference curve.

2. Indifference curve slope downwards:

It implies that as a consumer consumes more of one good, he must consume less of the other good. It happens because if the consumer decides to have more units of one good (say apples), he will have to reduce the number of units of another good (say bananas), so that total utility remains the same.

3. Higher Indifference curves represent higher levels of satisfaction:

Higher indifference curve represents large bundle of goods, which means more utility because of monotonic preference. Consider point 'A' on IC_X and point 'B' on IC_2 in Fig. 2.5. At 'A', consumer gets the combination (OR, OP) of the two commodities X and Y. At 'B', consumer gets the combination (OS, OP). As OS > OR, the consumer gets more satisfaction at IC_2.

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Properties of Indifference Curve:

4. Indifference curves can never intersect each other:

As two indifference curves cannot represent the same level of satisfaction, they cannot intersect each other. It means, only one indifference curve will pass through a given point on an indifference map. In Fig. 2.7, satisfaction from point A and from B on IC_1 will be the same.

Similarly, points A and C on IC_2 also give the same level of satisfaction. It means, points B and C should also give the same level of satisfaction. However, this is not possible, as B and C lie on two different indifference curves, IC_1 and IC_2 respectively and represent different levels of satisfaction. Therefore, two indifference curves cannot intersect each other.

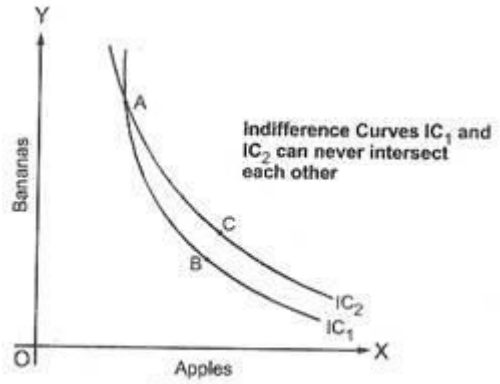

Fig. 2.7

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All consumers strive to maximize their utility. We try to get as much satisfaction as we can. The consumer's scale of preference is derived by means of indifference mapping that is a set of indifference curves which ranks the preferences of the consumer. Getting to the indifference curve which is farthest from the origin gives the highest total utility. Although the goal of the consumer is maximization of satisfaction, the means of achieving the goal is not clear. Higher indifference curve not only gives higher satisfaction but also are more expensive. Here we are confronted with the basic conflict between preferences and the prices of the commodities consumer wants to consume. With a given amount of money income to spent, we cannot attain the highest satisfaction but have to settle for less.

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CONSUMER'S EQUILIBRIUM IN CASE OF SINGLE COMMODITY

A consumer purchasing a single commodity will be at equilibrium, when he is buying such a quantity of that commodity, which gives him maximum satisfaction. The number of units to be consumed of the given commodity by a consumer depends on 2 factors:

1. Price of the given commodity

2. Expected utility (Marginal utility) from each successive unit.

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CONSUMER'S EQUILIBRIUM IN CASE OF TWO COMMODITIES

The Law of DMU applies in case of either one commodity or one use of a commodity. However, in real life, a consumer normally consumes more than one commodity. In such a situation, 'Law of Equi-Marginal Utility' helps in optimum allocation of his income. Law of Equi-marginal utility is also known as: (i) Law of Substitution; (ii) Law of maximum satisfaction; (iii) Gossen's Second Law.

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ORDINAL UTILITY APPROACH

The basic idea behind ordinal utility approach is that a consumer keeps number of pairs of two commodities in his mind which give him equal level of satisfaction. This means that the utility can be ranked qualitatively. The ordinal utility approach differs from the cardinal utility approach (also called classical theory) in the sense that the satisfaction derived from various commodities cannot be measured objectively. Ordinal theory is also known as neo-classical theory of consumer equilibrium, Hicksian theory of consumer behaviour, indifference curve theory, optimal choice theory. This approach also explains the consumer's equilibrium who is confronted with the multiplicity of objectives and scarcity of money income.

The important tools of ordinal utility are:

1. The concept of indifference curves.
2. The slop of I.C. i.e. marginal rate of substitution.

An indifference curve is a graph showing combination of two goods that give the consumer equal satisfaction and utility. Each point on an indifference curve indicates that a consumer is indifferent between the two and all points give him the same utility.

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MARGINAL RATE OF SUBSTITUTION

The marginal rate of substitution is the rate at which a consumer is ready to give up one good in exchange for another good while maintaining the same level of utility. At consumption levels, our marginal rates of substitution are identical. Under the standard assumption of neoclassical economics that goods and services are continuously divisible, the marginal rates of substitution will be the same regardless of the direction of exchange, and will correspond to the slope of an indifference curve passing through the consumption bundle in question, at that point: mathematically, it is the implicit derivative.

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The Budget Line

So far, we have discussed different combinations of two goods that provide same level of satisfaction.
But, which combination, will a consumer actually purchase, depends upon his income ('consumer budget') and prices of the two commodities.

Consumer Budget states the real income or purchasing power of the consumer from which he can purchase certain quantitative bundles of two goods at given price. It means, a consumer can purchase only those combinations (bundles) of goods, which cost less than or equal to his income.

Budget line is a graphical representation of all possible combinations of two goods which can be purchased with given income and prices, such that the cost of each of these combinations is equal to the money income of the consumer. Alternately, Budget Line is locus of different combinations of the two goods which the consumer consumes and which cost exactly his income.

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The Budget Line

Let us understand the concept of Budget line with the help of an example: Suppose, a consumer has an income of Rs. 20. He wants to spend it on two commodities: X and Y and both are priced at Rs. 10 each. Now, the consumer has three options to spend his entire income:

(i) Buy 2 units of X;

(ii) (ii) Buy 2 units of Y; or

(iii) (iii) Buy 1 unit of X and 1 unit of Y.

It means, possible bundles can be: (2, 0); (0, 2) or (1, 1). When all these three bundles are represented graphically, we get a downward sloping straight line, known as 'Budget Line'. It is also known as price line.

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The Budget Set

Budget set is the set of all possible combinations of the two goods which a consumer can afford, given his income and prices in the market.

In addition to the three options, there are some more options available to the consumer within his income, even if entire income is not spent. Budget set includes all the bundles with the total income of Rs. 20, i.e. possible bundles or Consumer's bundles are: (0, 0); (0, 1); (0, 2); (1, 0); (2, 0); (1,1). Consumer's Bundle is a quantitative combination of two goods which can be purchased by a consumer from his given income.

Diagrammatic Explanation of Budget Line:

Suppose, a consumer has a budget of Rs. 20 to be spent on two commodities: apples (A) and bananas (B). If apple is priced at Rs. 4 each and banana at Rs. 2 each, then the consumer can determine the various combinations (bundles), which form the budget line. The possible options of spending income of Rs. 20 are given in Table 2.7:

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Diagrammatic Explanation of Budget Line:

Table 2.7: Schedule of Budget Line

Combination of Apples and Bananas	Apples (A) 4 each)	Bananas (B) (Rs. 2 each)	Money spent = Income (Rs.)
E	5	0	(5 x 4) + (0 x 2) = 20
F	4	2	(4 x 4) + (2 x 2) = 20
G	3	4	(3 x 4) + (4 x 2) = 20
H	2	6	(2 x 4) + (6 x 2) = 20
1	1	8	(1 x 4) + (8 x 2) = 20
J	0	10	(Ox 4)+ (10×2) =20

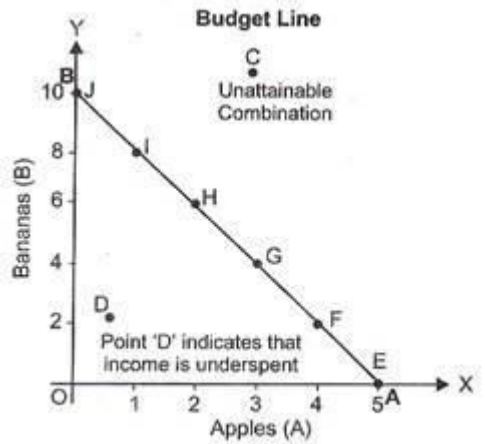

Fig. 2.8

In Fig. 2.8, number of apples is taken on the X-axis and bananas on the Y-axis. At one extreme (Point 'E'), consumer can buy 5 apples by spending his entire income of Rs. 20 only on apples. The other extreme (Point 'j'), shows that the entire income is spent only on bananas. Between E and J, there are other combinations like F, G, H and I. By joining all these points, we get a straight line 'AB' known as the Budget Line or Price line.

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Diagrammatic Explanation of Budget Line:

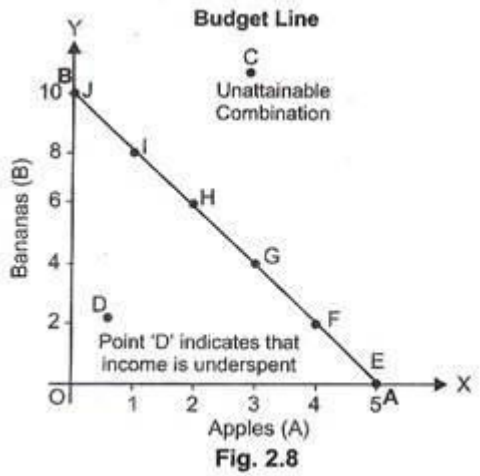

Fig. 2.8

Every point on this budget line indicates those bundles of apples and bananas, which the consumer can purchase by spending his entire income of f 20 at the given prices of goods.

Important Points about Budget line (Refer Fig. 2.8):

1. Budget line AB slopes downwards as more of one good can be bought by decreasing some units of the other good.
2. Bundles which cost exactly equal to consumer's money income (like combinations E to J) lie on the budget line.
3. Bundles which cost less than consumer's money income (like combination D) shows under spending. They lie inside the budget line.
4. Bundles which cost more than consumer's money income (like combination C) are not available to the consumer. They lie outside the budget line.

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Algebraic Expression of Budget Line :

The budget line can be expressed as an equation:

$M = (P_A \times Q_A) + (P_B \times Q_B)$

Where:

M = Money income;

Q_A = Quantity of apples (A);

Q_B = Quantity of bananas (B);

P_A = Price of each apple;

P_B = Price of each banana.

All points on the budget line 'AB' indicate those bundles, which cost exactly equal to 'M'.

Algebraic Expression for Budget Set: The consumer can buy any bundle (A, B), such that: $M > (P_A \times Q_A) + (P_B \times Q_B)$

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Slope of the Budget Line:

We know, the slope of a curve is calculated as a change in variable on the vertical or Y-axis divided by change in variable on the horizontal or X-axis. In the example of apples and bananas, slope of the budget line will be number of units of bananas, that the consumer is willing to sacrifice for an additional unit of apple.

Slope of Budget Line = Units of Bananas (B) willing to Sacrifice/ Units of Apples (A) willing to Gain = $\Delta B/\Delta A$
As seen in Fig. 2.8, 2 bananas need to be sacrificed each time to gain 1 apple.
So, Slope of Budget Line = -2/1 = **2/1 = 2
Numerator will always have negative value as it shows number of units to be sacrificed. However, for analysis, absolute value is always considered.

This slope of budget line is equal to 'Price Ratio' of two goods.

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What is Price Ratio?

Price Ratio is the price of the good on the horizontal or X-axis divided by the price of the good on the vertical or Y-axis. For instance, If good X is plotted on the horizontal axis and good Y on the vertical axis, then:

Price Ratio = Price of X (P_X)/Price of Y(P_Y) = P_X /P_Y

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Why slope of Budget Line is represented by Price Ratio?

A point on the budget line indicates a bundle which the consumer can purchase by spending his entire income. So, if the consumer wants to have one more unit of good 1 (say, Apples or A), then he will have to give up some amount of good 2 (say, Bananas or B)'The number of bananas needed to be given up to gain 1 apple depends on the prices of apples and bananas.

As per Table 2.7, Apple (A) is priced at Rs. 4 (P_A) and Bananas (B) at Rs. 2 (P_B). It means, to gain 1 apple, consumer will have to reduce his expenditure on bananas by Rs. 4, i.e. consumer will have to sacrifice 2 bananas to gain 1 apple. It means, consumer will have to give P_A/P_B units of Banana to gain one apple. P_A/P_B is nothing but the price ratio between Apples and Bananas. So, it is rightly said that Price Ratio indicates the slope of Budget Line.

Moreover, Price ratio remains constant throughout because P_X and P_Y on the basis of which AX and AY are calculated are constant throughout.

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Shift in Budget Line:

Budget line is drawn with the assumptions of constant income of consumer and constant prices of the commodities. A new budget line would have to be drawn if either (a) Income of the consumer changes, or (b) Price of the commodity changes.

Let us understand this with the example of apples and bananas:

1. Effect of a Change in the Income of Consumer:

If there is any change in the income, assuming no change in prices of apples and bananas, then the budget line will shift. When income increases, the consumer will be able to buy more bundles of goods, which were previously not possible. It will shift the budget line to the right from 'AB' to 'A_1B_1', as seen in Fig. 2.9. The new budget line A_1B_1 will be parallel to the original budget line 'AB'

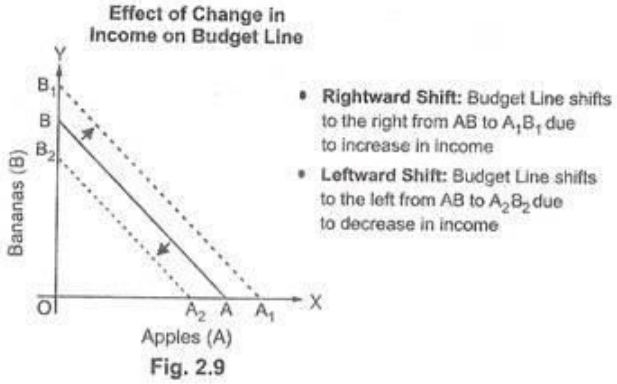

Fig. 2.9

Similarly, a decrease in income will lead to a leftward shift in the budget line to A_2B_2.

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Shift in Budget Line:

2. Effect of change in the relative Prices (Apples and Bananas):

If there is any change in prices of the two commodities, assuming no change in the money income of consumer, then budget line will change. It will change the slope of budget line, as price ratio will change, with change in prices.

(i) Change in the price of commodity on X-axis (Apples):

When the price of apples falls, then new budget line is represented by a shift in budget line (see Fig. 2.10) to the right from 'AB' to 'A_1B'. The new budget line meets the Y-axis at the same point 'B', because the price of bananas has not changed. But it will touch the X-axis to the right of 'A' at point 'A_1, because the consumer can now purchase more apples, with the same income level.

Similarly, a rise in the price of apples will shift the budget line towards left from 'AB' to 'A_2B'.

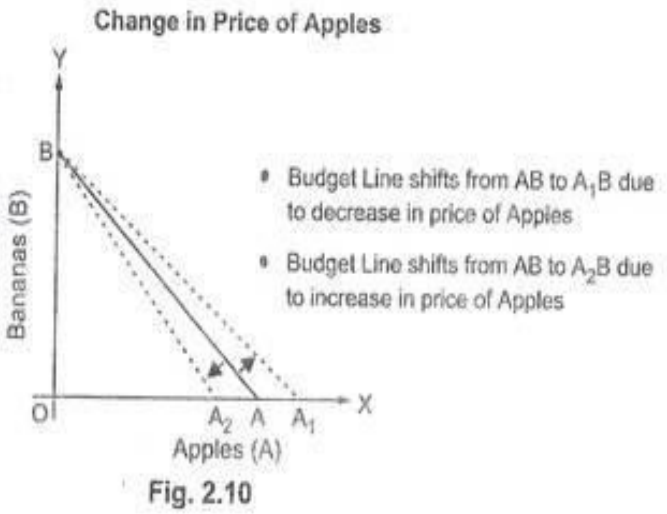

Fig. 2.10

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Shift in Budget Line:

2. Effect of change in the relative Prices (Apples and Bananas):

(ii) Change in the price of commodity on Y-axis (Bananas):

With a fall in the price of bananas, the new budget line will shift to the right from 'AB' to AB_1 (see Fig. 2.11). The new budget line meets the X-axis at the same point 'A', due to no change in the price of apples. But it will touch the Y-axis to the right of 'B' at point 'B_1', because the consumer can now purchase more bananas, with the same income level.

Similarly, a rise in the price of bananas will shift the budget line towards left from 'AB' to 'AB_2'.

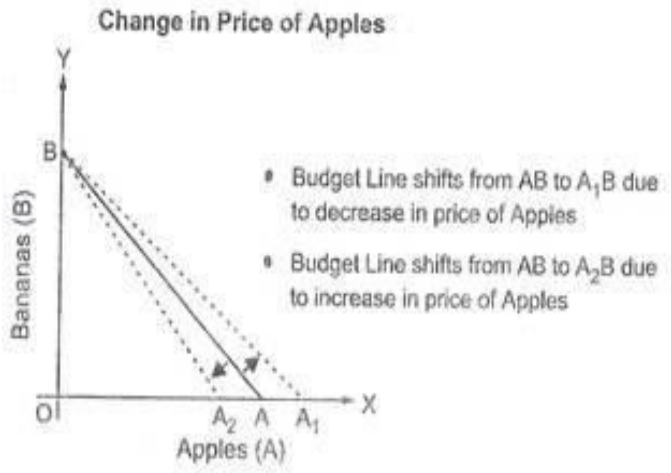

Fig. 2.10

CONSUMER'S EQUILIBRIUM

Understanding Consumer's Equilibrium by Indifference Curve Analysis:

Consumer equilibrium refers to a situation, in which a consumer derives maximum satisfaction, with no intention to change it and subject to given prices and his given income. The point of maximum satisfaction is achieved by studying indifference map and budget line together.

On an indifference map, higher indifference curve represents a higher level of satisfaction than any lower indifference curve. So, a consumer always tries to remain at the highest possible indifference curve, subject to his budget constraint.

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Understanding Consumer's Equilibrium by Indifference Curve Analysis:

Conditions of Consumer's Equilibrium:

The consumer's equilibrium under the indifference curve theory must meet the following two conditions:

(i) MRS_{XY} = Ratio of prices or P_X/P_Y

Let the two goods be X and Y. The first condition for consumer's equilibrium is that

$MRS_{XY} = P_X/P_Y$

a. If $MRS_{XY} > P_X/P_Y$, it means that the consumer is willing to pay more for X than the price prevailing in the market. As a result, the consumer buys more of X. As a result, MRS falls till it becomes equal to the ratio of prices and the equilibrium is established.

b. If $MRS_{XY} < P_X/P_Y$, it means that the consumer is willing to pay less for X than the price prevailing in the market. It induces the consumer to buys less of X and more of Y. As a result, MRS rises till it becomes equal to the ratio of prices and the equilibrium is established.

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Understanding Consumer's Equilibrium by Indifference Curve Analysis:

Conditions of Consumer's Equilibrium:

The consumer's equilibrium under the indifference curve theory must meet the following two conditions:

(ii) MRS continuously falls:

The second condition for consumer's equilibrium is that MRS must be diminishing at the point of equilibrium, i.e. the indifference curve must be convex to the origin at the point of equilibrium. Unless MRS continuously falls, the equilibrium cannot be established.

Thus, both the conditions need to be fulfilled for a consumer to be in equilibrium.

Let us now understand this with the help of a diagram:

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Understanding Consumer's Equilibrium by Indifference Curve Analysis:

Conditions of Consumer's Equilibrium:

(ii) MRS continuously falls: Let us now understand this with the help of a diagram:

In Fig. 2.12, IC_1, IC_2 and IC_3 are the three indifference curves and AB is the budget line. With the constraint of budget line, the highest indifference curve, which a consumer can reach, is IC_2. The budget line is tangent to indifference curve IC_2 at point 'E'. This is the point of consumer equilibrium, where the consumer purchases OM quantity of commodity 'X' and ON quantity of commodity 'Y.

All other points on the budget line to the left or right of point 'E' will lie on lower indifference curves and thus indicate a lower level of satisfaction. As budget line can be tangent to one and only one indifference curve, consumer maximizes his satisfaction at point E, when both the conditions of consumer's equilibrium are satisfied:

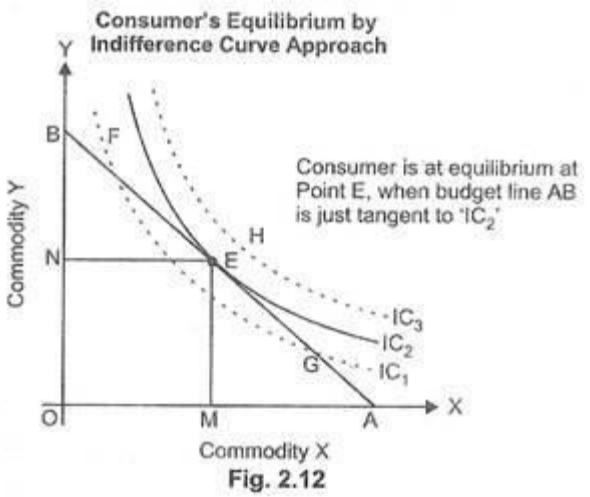

Fig. 2.12

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Understanding Consumer's Equilibrium by Indifference Curve Analysis:

Conditions of Consumer's Equilibrium:

(ii) MRS continuously falls: Let us now understand this with the help of a diagram:

(i) MRS = Ratio of prices or P_X/P_Y:

At tangency point E, the absolute value of the slope of the indifference curve (MRS between X and Y) and that of the budget line (price ratio) are same. Equilibrium cannot be established at any other point as $MRS_{XY} > P_X/P_Y$ at all points to the left of point E and $MRS_{XY} < P_X/P_Y$ at all points to the right of point E. So, equilibrium is established at point E, when $MRS_{XY} = P_X/P_Y$.

(ii) MRS continuously falls:

The second condition is also satisfied at point E as MRS is diminishing at point E, i.e. IC_2 is convex to the origin at point E.

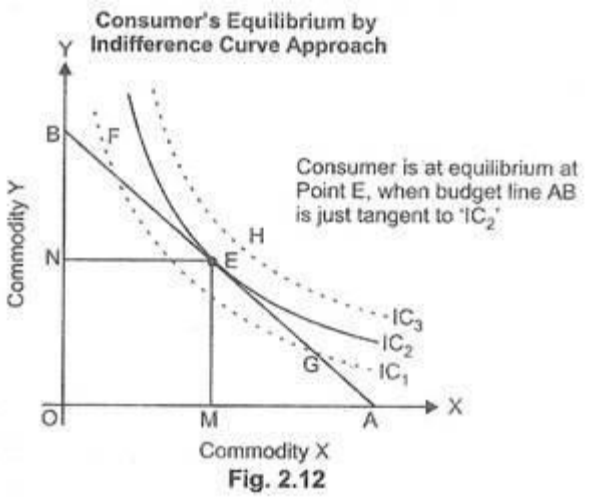

Fig. 2.12

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