An Introduction to Microeconomics
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Lecture - 59
Marginal Utility Vs. Marginal Rate of Substitution (MRS)

Now, let us use the concept let us learn about marginal utility, although, we talked about marginal utility earlier also, but just what is marginal utility?

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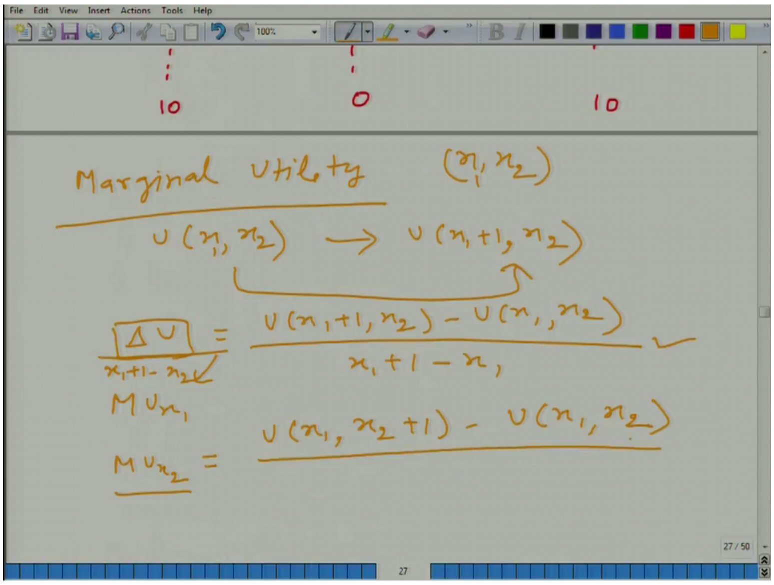

So, it is the amount of amount by which total utility increases every increase one good in the bundle by 1 unit while keeping all other goods in the bundle fixed. And then it is marginal utility with respect to that particular good which amount has been increased ok.

So, let us say what we mean here is we have utility some utility let say for a bundle let say this is of course, if you are using notation x comma y that it donates it represents a bundle; what is happening and if we can use our earlier notation also x 1 comma x 2 what we have here is x 1 comma x 2 ok.

So, what we are saying that we keep x 2 fixed while we increase x 1 by 1 unit. So, what is happening x 1 plus 1 this will be the new utility and let us say if it satisfies monotonicity then of course, in the new bundle we have same amount of good 2, but more of good 1. So, of course, here utility will be higher. So, the increase in utility is let say that change in utility is denoted by delta U then it is going to be U x 1 plus 1 comma x 2 minus U of x 1 comma x 2. And denominator although we do not have anything in the denominator or we have 1 in the denominator; I can write it like x 1 plus 1 minus x 1 that is what we have and this this is basically defined as marginal utility with respect to x fine.

But here what we are doing we are changing x 1 by one unit what is the marginal?

Student: Sir that could be delta U upon delta x

No wait we will we are talk here basically is again if you have you are talking about delta U by delta x let me explain it to you; how we reach there. Basically what we are talking about here is delta U is in the numerator and in the denominator we have 1; 1 we can express as x 1 plus 1 minus x 2 and that is the that is that is equivalent to 1 and this is marginal utility with respect to x 1; I will come back to the calculus the definition that we gave earlier using calculus.

Now, let us look at the marginal utility with respect to x 2; what it means? That we keep x 1 fixed and we increased x 2 by 1 unit and here we have and of course, denominator we can leave it as it is does not matter; this is marginal utility with respect to x 2, but now what we are doing? We are changing x 1 by 1 unit; what we can do that rather than changing x 1 by 1 unit.

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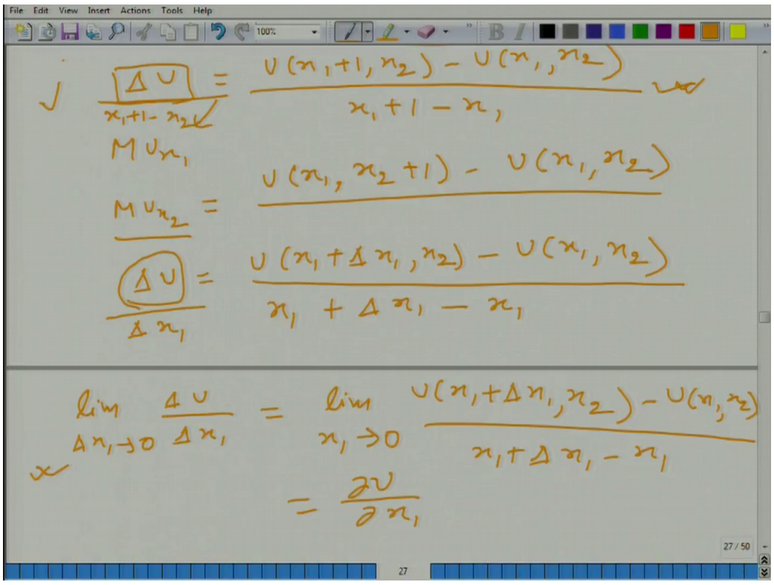

Let us look at the change in change in utility if we change x 1 by delta x 1 unit very small unit and then what we have here is x 1 plus delta x 1 comma x 2 minus U x 1 x 2 fine.

And what we have this delta U is now change because of delta x 1 unit change in amount of good 1 in the bundle fine so, but delta x 1 can be anything. So, rather than talking about absolute change; we should talk about rate of change and how can we get the rate of change? If we divide it by x 1 then this is the rate of change. And here also we can divide it by we will have to divide it by delta x 1 and delta x 1 can be written as x 1 plus delta x 1 minus x 1.

And now if we can take limit where delta x 1 is going to 0 what will we get? Delta U by delta delta x 1 is equal to limit x 1 is going to 0; U x 1 plus delta x 1 comma x 2 minus U of x 1 comma x 2 divided by x 1 plus delta x 1 minus x 1. And this is nothing, but the partial derivative of U with respect to x 1. So, both definitions are fine this is more precise; here we are talking about rate of change in U with respect to x 1 while keeping x 2 fixed in the bundle.

This gives us marginal utility with respect to x 1; here we are taking approved way because sometime we do not know calculus, then we use this if we if we do not know calculus then we can use this definition and then we have one in the denominator because delta x 1 is 1 in that particular case fine and this is marginal utility, but here is the problem we have learned about marginal utility.

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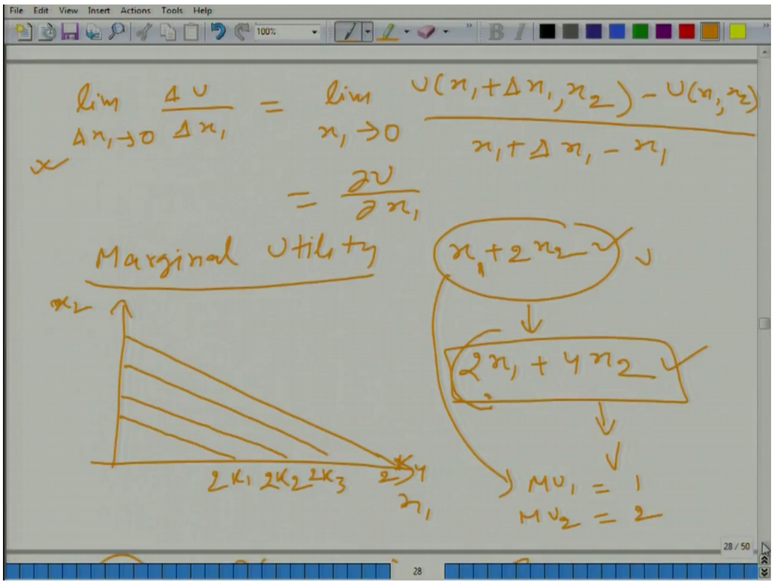

Let us look at the one particular problem that marginal utility leads to. Let me just draw this problem and then I will come back to the problem that we intended to solve right in the beginning of this topic ok. So, what we will do? We will come back to that topic and we will solve it using some other technique, but we should also learn the problem with the marginal utility concept.

Now, what is happening let us draw the indifference map for x plus 2 y or if we want to convert it if we want to denote it by x 1 and 2 x 1 the problem would remain the same its the same problem; does not matter. So, you can change the variable because x 1 and x 2 they are just representing their the name; so, does not matter. So, here we have x 2 and here we have x 1; when we draw it how would it look like? Downward sloping with slope minus; minus 1 by 2 something like this it would look like fine and let say let us start if we can say this is we have here K 1 K two K three K four

Now, instead of using this notation K 1, K 2, K 3, K 4 can I use this notation it is 2 K 1, 2 K 2, 2 K 3 and 2 K 4 or in other words rather than using x 1 plus two x 2 can I use 2 x 1 plus 4 x 2; will it represent the same preference nothing would change why because utility is ordinal in nature it is about order fine

So, now what we are saying that this these two utility functions; they represent the same preference nothing different. Now get the marginal utility for both of these utility function; marginal utility with respect to x 1; what will you get?.

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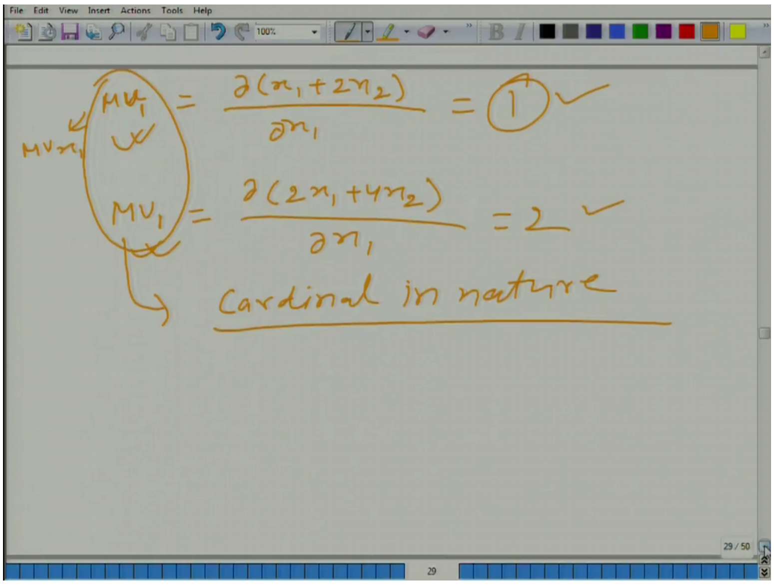

Marginal utility in case of let us say in shortcut M U 1 represent with respect to first argument we have also written it as M U x 1 and what we have is d x 1 plus 2 x 2 with respect to x 1 and we get here 1. Or what we are saying is in other word; if we do not use the calculus definition; what we can use our non-calculus definition. So, if we increase x 1 by 1 unit how much will be increase in total utility? 1 same as this fine

Now, how about M U 1? In the let us denote this utility function as U and this utility function as V. So, what will be M this is U and this is V; what will be the marginal utility in this case? It is 2 again use non-calculus definition if you increase x 1 by 1 unit; how much increase will you get while keeping x 2 fix? How much increase will you get in the total utility 2; according to this.

Now, what is happening in one case we are getting 1, in another case we are getting 2. So, it seems that marginal utility is related to it somehow cardinal in nature cardinal in nature; it assumes that the value attached to a particular rank is can be doubled can be halved ok.

So, remember earlier we discussed that these; these were quite important when we studied utility function as cardinal in nature, cardinal utility function, but now we have figured out that utility we do not need cardinality of utility function; ordinality will work well. But when we are talking about ordinality we should not be moved by the value of M U 1 or M V 1 because they are cardinal in nature. So, be very vary of using M U 1 and

M V 1marginal utility in your practical problems because you will reach to wrong place if you do not know fine.

So, what is the solution? The solution we will see immediately again let us solve this problem using the technique that we have learned in the class ok. Earlier we solve it using just description and then table; now let solve it using the techniques that we have learned.

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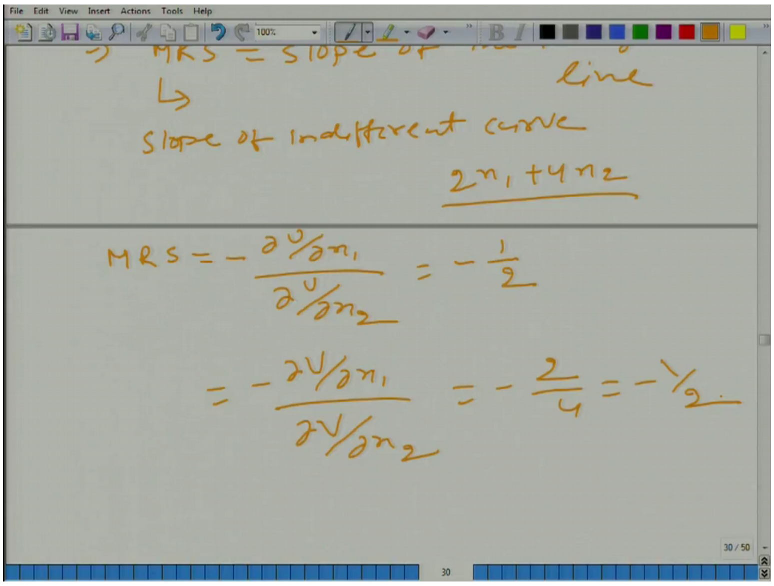

And what did we learn? That we learned that M R S should be equal to the slope of the budget line or in other words M R S is nothing, but the slope of slope of in different curve fine.

Now, let us calculate M R S in both the cases what does it equal to? It is equal to the exchange rate that you have in your mind at that particular bundle of course, in some of the cases your exchange rate that you are comfortable with in your mind would change as you have different bundles, but in this particular case what is happening? Exchange rate remains the same; it does not depend on how many units of good 1 or good 2 you have fine

So, how much is M R S? If we use calculus to calculate M R S is equal to this is what it is equal to I have used earlier x for x 1 and y for x 2, but let us take to that this fine and how much is this? Minus for the first utility case for the first utility case from here what we can get M U 1 is 1 and M U 2 is 2 fine.

And for the second case for the second case that is 2 x 1 plus four x 2; 2 and 4. So, what we get in the first case its half and if you take another utility function that is what we have is minus 2 by 4 and that is half. So, M R S; M R S is independent of the particular selection of the utility function; what we have learned let me just emphasise this point once again why we are getting something like this?

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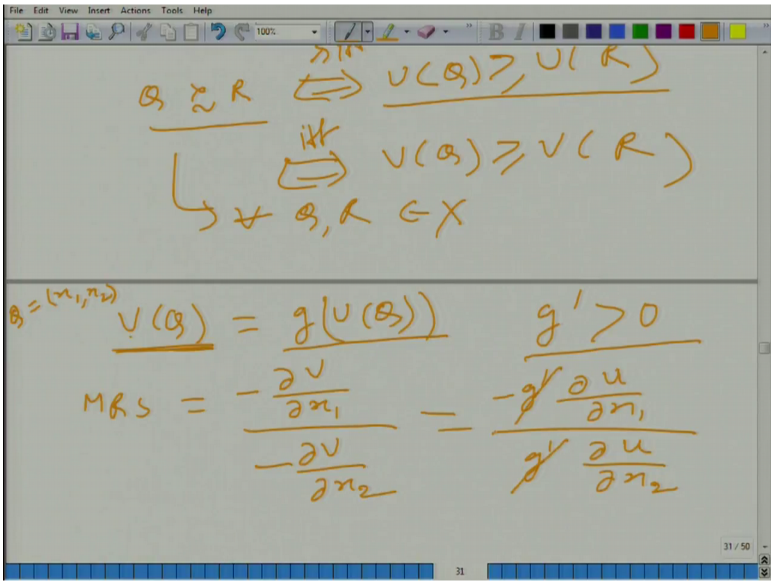

So, what we learned earlier that if we have preference such that this then it you will be able to represent of course, it should satisfy some axioms that we have discussed; that this and then any monotonic transformation of this utility function would also work. This is what we have of course, this symbol says if and only if and only if. So, both ways fine for all x 1 and x 2 in the consumption set.

So, in other word in other word what is V x 1; V x 1 of course, right now let us choose some other because it will lead to confusion we are using x 1 and x 2 for not different bundles for to denote the amount of a particular good in the bundle. So, rather than using x 1 and x 2; we can take it here P and Q we have R Q; let us take Q and R sorry because P again is what? Price is it clear? This is for all Q and R in x

So, now when we take V of Q of course, V is monotonic transformation of U. So, what how can we write it? This is nothing, but g of U of Q and where g dash is greater than 0 by our definition; we have discussed it in the class fine. So, now, let us calculate M R S using this particular function and what is this equal to minus d V with respect to x 1 because remember we are talking about two good world Q has two goods x 1 and x 2 divided by partial derivative of V with respect to x 2 fine.

And when we use this; what we will get? Minus g dash d U partial derivative of U with respect to x 1 minus again here g dash partial derivative of U with respect to x 2.

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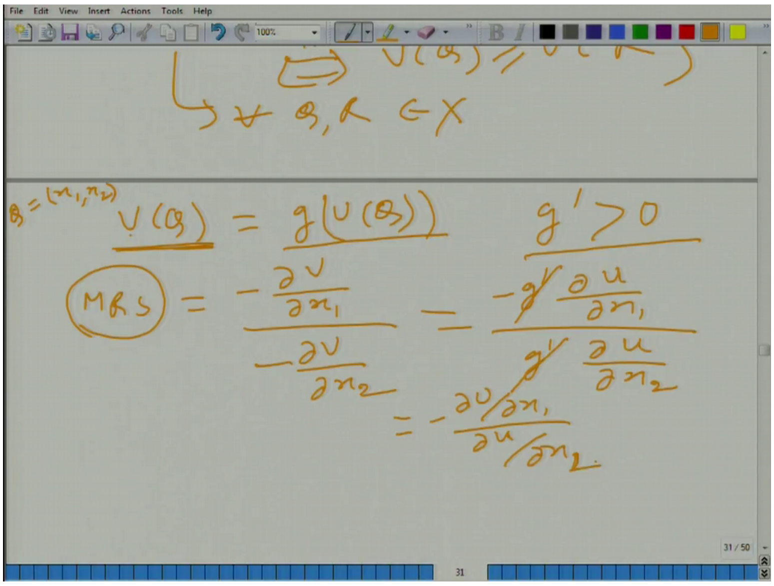

So, this will get cancelled and we are back to the M R S; which we calculate we calculated with the first utility function representing the preference of this particular person. So, M R S is independent of monotonic transformation of utility function. So, it does not depend on the particular valuation; it is x 2 yes fine it is clear?