An Introduction to Microeconomics
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Lecture - 78
Average and Marginal Product of Labour (APL & MPL)

So, now let us take numerical example, what we have here is let say capital as we have fixed at 5.

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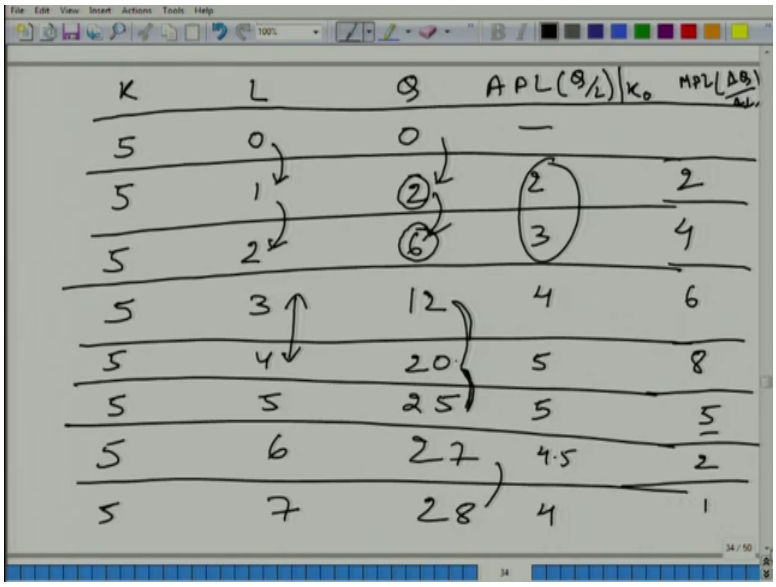

And here we have labour and, where we have output. So, let say let us take some example, labour is 0 it is possible that to produce something, but we will take that here in this example when labour is 0 cap output is also 0. It is a made up example, then what we have that capital at the same labour; labour, goes up to1, then let us a total output is 2, I am trying to create a table and then again it is fixed at 5 it is labour is increased from1 to 2 or output goes up from 2 to 6 ok.

Now, you got that draft what I am doing I am again keeping the capital fixed at 5 and increasing labour from 2 to 3 and, output goes up from 6 to 12 and. So, on I have already this there is nothing sacrosanct about this example, this is an artificially example that I have created to illustrate certain concepts.

So, let me just quickly make it 12 and then 20, if you say 20 25 I am not see function, if you remember function is thus just the combination of you know some inputs and outputs, some independent variable and dependent variable, some time we get algebraic expression, some time we do not get algebraic expression. So, let us not worried about let us not worried about algebraic expression that is not the aim right now, 6 it should be 5 6 27.

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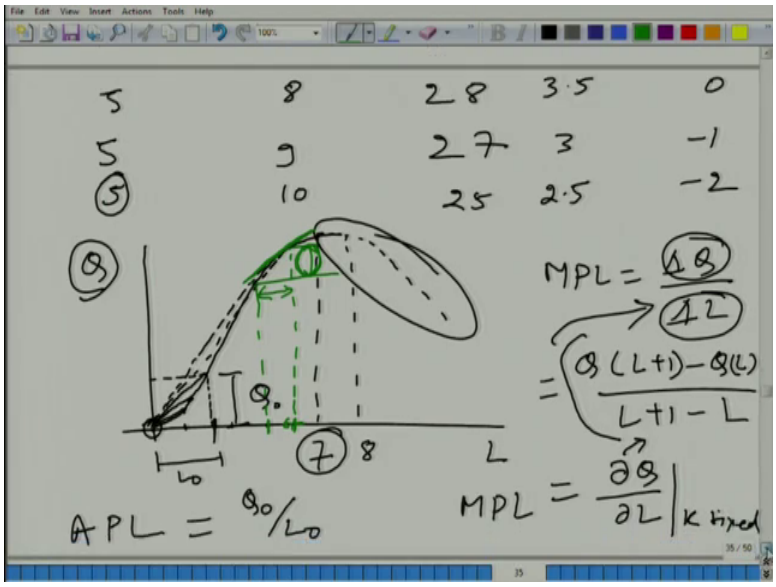

Let say 5 4 28 5 8 28 5 9 27 10 5 10 and 25, now what we can talk about is that average productivity of labour APL, what is average productivity of labour, average productivity of labour is Q by L of course for fixed capital; capital, has to be fixed.

We are talking about and of course, average product, but first let me tell you what is average productivity of labour in words that it is the on average contribution of a1 labour in production and of course, production depends here not only on labour, but also on capital, but since we are talking about labour, we are we have we are keeping any way we are talking about short run. So, we are keeping capital fixed.

So, what is the average contribution here, we cannot define how about here 2 how about here 4 20 by 4 5 25 by 5 5 here 4.5 here 4 here 3.5 3 2.5, now deliberately I have created this fine it is clear.

Now, we can also define similarly marginal productivity of labour. And what is marginal productivity of labour, change in output divided by change in labour, or in other word that intribu incremental contribution of additional labour ok, ma you know incremental contribution. So, here we can start calculating from here labour went up from 0 to1 what happened to the output it went up by 2 unit. So, by adding1 more labour we increased output by 2 units.

So, marginal contribution marginal productivity of labour is 2. Similarly from here to here again labour went up by labour is has gone up by1 unit. So, how much we cannot look at here, we have to look at here, why because earlier output was 2, but by adding1 more unit of labour, we are able to increase output to 6 units.

So, here it is 4 and so on, if you calculate here we get 8 basically see here the jump is of jump is worth1 unit. So, what we have to get basically is difference between these 2 and 20 minus 12 is 8. Similarly for here we have to get difference from between these 2 and it is equal to 5 here 2, here1, here it is 0 minus1 here minus 2.

So, now I believe you understand the concept of average productivity of labour and well as marginal productivity of labour. If we plot this here we have total output and here we have labour how would it look like.

Student: (Refer Time: 06:19).

Just that nothing more.

Student: (Refer Time: 06:24).

First it is increasing at the here let say, here we have1, here we have 2, here we have 3, here we have 4. So.

Student: (Refer Time: 06:40).

Not a straight line in is if you do not know what happening in the middle. So, initially it is increasing at the slowery, then it fix up, then it rate of increase decreases and then it starts decreasing overall. So, what we have basically is something like something I let us not put it to the scale roughly I am saying, what we have is basically like let us we put let me put here.

Student: But it is 2 4 6 8. So, it is following (Refer Time: 07:11).

Not to 4 I am here is Q total output it is 2 6 12 20 and, it picks up were at 28. So, like we can say this is 7, or here it is like this like this and here also it is this is 8 fine it is clear.

Student: (Refer Time: 07:40) to produce one thing more than labour required, I am working on it. So, they are getting into each others way and they is not much work as per the.

So, one story that you can make that here, capital represents number of computer and labour represents number of engineers coders ok, nam then what is happening that earlier the com you have 0, you have no coder you have no engineer. So, all computers are laying ideal.

So, you have 0 output, as you start adding engineers they start occupying computer and start working. So, you have basically 5 computers but till 7 because you know not all of them are working all the time. So, they can share computer, but after certain labour what is happening is that the there is some kind of crowding, you know like there are more people than number of terminals ok.

So, 1 I of course, I am not saying that happens all the time, but it is possibility that if there are more people they would start chatting and the productivity would go down. So, typically it has been observed that if you increase1 factor beyond the limit you know limit would vary in each of this cases, then the productivity starts decreasing that is is what happening here fine is it clear.

Now, tell me how can we represent average productivity of labour on this graph, what is average productivity of labour on this graph, slope of line from origin to that particular label of output, like let say if I want to calculate average productivity of labour at this point what we will do, I will go here and see how much is the output, this is the output at this particular level, and we will draw a line from this point to the origin, hum what is this is Q at this label let say it is a Q not and what is this L naught.

So, this is how we have define the Q naught divided by L naught is the average product of labour in, we are keeping the capital fixed fine. So, at any point we want to get the average product of labour. So, what we have to do is we have to draw a line. So, what we

can observe here, in this graph that first average product of line, average product of labour is increasing till probably this point and, then it starts decreasing.

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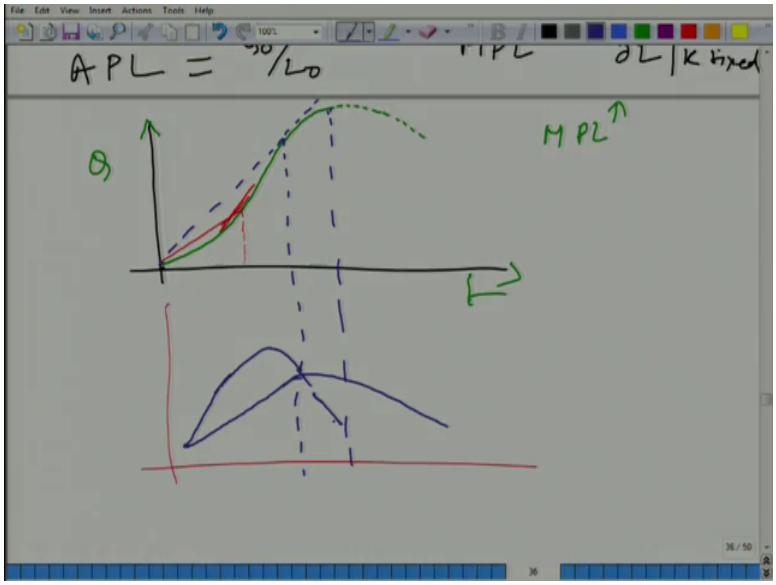

So, average product if we draw here let say we can say that average product of labour is increasing and then it start decreasing, how about marginal product of labour, how can we get the marginal product of labour at any this point. Slope of tangent at each point. Remember how we have defined? We have define marginal product of labour as incremental contribution of additional labour.

So, marginal product of labour is delta Q divided by delta, what is delta Q change in amount of output and, what is delta L change in amount of labour, but the way when we say again I keep repeating this again and again, but so I will do it1 more time that when we are talking about incremental contribution of an additional labour, what we are talking about that Q of L plus1 minus Q of L, and L plus1 minus l, but this is not very precise.

This de the above definition is precise here, we are the increment the increment is equal to1 labour, but if we have a continuous function, then we can take even smaller increments and, if we take small enough increment what we will get as m marginal product of labour g cube del Q by del L, why del why this partial derivative because capital is fixed ok. So, we can say capital fixed, and what is this del Q by del L how can

we represent it in this graph this is the tangent, this is the slope of the tangent to the total output curve at1 particular label of labour ok.

So, let see if you want to in this graph in this graph, we want to figure out what is marginal product of labour, what we can do,1 way to do it is the decrease labour by1 unit of course, we will get here and see how much is how much is the change in output and, this much is the change in output ok. And this is the change in labour that is equal to 1.

So, marginal product of labour is nothing, but this amount, but this is basically crude way of getting the marginal product of labour better would be to have just small you know, or we can talk about small increment here, we do small increment and see how much the capital has changed. If the increment is small enough how much output has changed, if they increment is small enough, what do we get we get the slope of ta this we get the tangent at that particular point. And the slope of this tangent is marginal product of labour fine.

So, we get the marginal product of labour given here as the above ok. So, what we can say here, if you look at this point, if you look at this point which1 is higher MPL is higher why because, here it is steeper it is steeper. So, steeper means higher slope. So, tell this point if you where it was tangent let me draw again, I have already made that graph let us draw simpler one, this would be doted rather, why I am using doted by the way why not the.

Student: Sir because we put the assumption that forms would increase their productivity and, if a product is coming down then this.

Ok.

Student: And this closes to have (Refer Time: 14:59).

Definitely; So, what we are, but again the definition of the production function we are drawing this, this is basically production function Q as function of L, production function in 1 variable and what was the products definition of production function that, we gave earlier the maximum label that can be produced.

So, here if you come if you look at this table using 9 how much maximum you can produce 28 not 27 not 27 free you what you will do of course, when you are using 9

whole units, you will produce 27 as the table gives, but what did we talk about earlier, that you can freely dispose. You can freely dispose some of the inputs and you will dispose probably 2 unit1 unit or 2 unit and you will come to this that is way of course, here I am drawing the functions that is way it is going down.

But the production function cannot go down beyond this point, it will be fixed you will freely dispose off because; we are talking about efficient label of production as you said fine ok. So, here we have Q and here we have L and let say at this point or rather take this. So, slope of course, this is from origin the slope of this 9 is the average product of labour and, how much is the marginal product of labour at this point, this is the slope of tangent it is clear.

And so, marginal product of labour is more than average product of labour and so, here if we draw. So, till this point it seems ok, we have another here it achieves maximum. So, if we follow this. So, what is happening is basically the average product of labour is increasing, till this point and then it is decreasing that is not accurate it is very rough done.

And they if we take the marginal product of labour what is happening at this quantity same that here, it is higher and how about at this point, they are equal because this line becomes tangent done ok. So, basically just what will happen that at this point it will be like this ok.