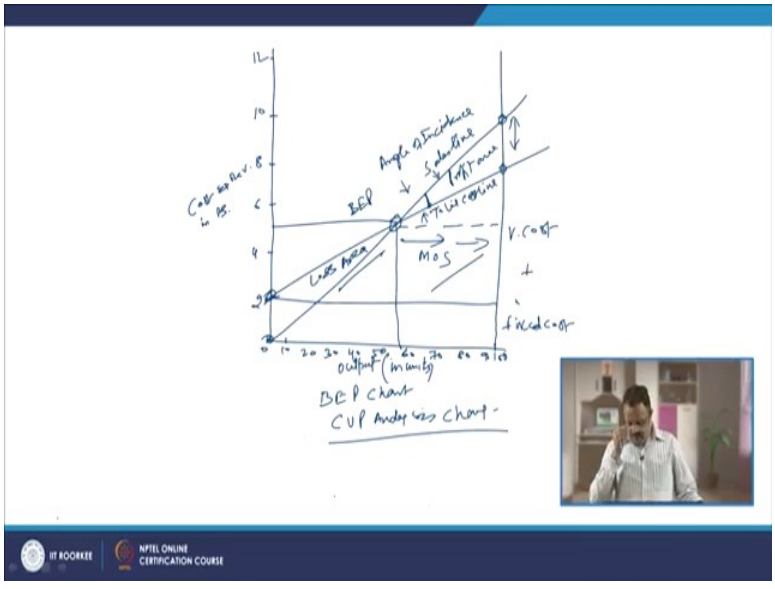
Management Accounting
Professor Anil K. Sharma
Department of Management Studies
Indian Institute of Technology Roorkee
Lecture- 47
CVP analysis

Welcome students, so we are in the process of learning about the marginal costing and in the say, previous class I discussed with you some concepts, basic concepts and some formulas to say make use of this concept of the or this technique of the marginal costing. So, now before we move to solve some problems and learn how to implement, this technique for management decision making and the different organizations or different companies, I would like to discuss with you the say the breakeven chart or other way around you call it as a cost volume profit analysis chart, right CVP chart, cost volume profit analysis chart.

So, breakeven chart, we call it as breakeven chart but it depicts many things and with the help of this chart you will be able to understand certain more things also, which otherwise we will you were not able to or those things for not clear to you. So, in this case how to prepare this breakeven chart or the cost volume profit analysis chart, we can do it like this, right.

(Refer Slide Time: 01:23)



You have to create a structure like this, in this say, x axis you have to take the output and then you have to take the output that is in the units, output in units and here you have to take the cost and revenue, cost and revenue in rupees or dollars whatever it is given to us, you have to take it like this and once you means draw these lines, we will see that this is the fixed cost

line, this is the total sales line and this is the total cost line, right and now we will draw a line here closing the this side.

So, now this I would say it is the up to this is the fixed cost, right up to this is the fixed cost and this is the variable cost area, this is the variable cost. So, it will be fixed plus variable cost, the total cost will be here and in this side we will take the revenue. So, we will take the for example, the units here there is 0 that we can say it is 10, 20, it is 30, it is 40, it is 50, it is 60, it is 70, this is 60, this is 70, this is 80, this is 90 and this finally can be 100 you can say, right.

For example, this is the number of units, maybe it can be thousand, it can be numbers or it can be any volume, an any amount and here we take the things as for example let us in the lakhs 2, then it is 4, then it is 6, then it is 8 and it is 10 and finally it can be 12, right. So, these can be the means the revenue line, here is the revenue line. So, it means here we have taken the output in the units and here we are taking the cost and the revenue.

So, this line is the you can call it as the sales line, this line is called as the sales line and this line is called as the second line which you call here is the, this line is called as the total cost line, total cost line, sales line and the total cost line. So, this line is the total cost line, this line is the total sales line, right here is one angle, angle here it is called as the angle of it is called as the angle of incidence, say angle of incidence and if you take this point, this point is called as the breakeven point, we take this and this, this is the breakeven point, right.

Here it is some number of revenue of the sales that by selling for example, say 4.5 or the 6 lakhs of the sales and here in terms of the units you can call it as somewhere 58,000 units by sailing these units in the market we will be reaching at the breakeven point, right this is the total cost line, lower line and this is the breakeven total sales line and this is angle of incidence and this area is called as the profit area, this area is profit area, this area is called as the loss area.

So, you can understand here, that we are divided the total cost this up to this point it is the cost, so this is a total cost line and the total cost is the sum of the fixed cost plus variable cost, right and after that means we have this total cost lines. So, this total cost starts from there means up to from this point to this point it is the fixed cost and after that the variable cost is starts and the total cost line go like this.

This line is here, which is starting from the 0, this is a sales line and because sales maybe 0 even when there is a minimum fixed cost because fixed cost always remains whether you go for the production, you do not go for the production fixed cost has to be there, so fixed cost is here, this is a point of fixed cost, this is the point of the sales when the sales are even 0 the fixed cost is also there and when sales are going to come up, so it means the variable cost will also start incurring at that time.

So, it means initially your sales line is lower as compare to the total cost line, right. So, what is happening? Initially because the fixed cost is very high and we added the variable cost also, so what happens that in the initial level of production when it reaches at the breakeven point till then the cost is more and the revenue is less sales are less, so this line is going like this, the sales line as lower than the cost line and at one point of this operations we reach it at a point which is called as a breakeven point means the point of the no profit or no loss.

You can understand here, that sales line is going like this, cost line is going like this and at this point they are intersecting with each other, this point is the where the cost and revenue, cost and sales are equal to each other. So, it means, up to this point means the firm is not earning any profit only the firm is recovering the cost but if for example, if the sales level is less than this area during this area then this area is the area of loss because here the cost is more, revenue is less, sales are less.

So, ultimately up to this point the firm has to incur a loss and at this point we will reach at the breakeven point and after that the sales line, total sales line will cross and will go above the total cost line and this area from the breakeven point onwards it is called as the profit area, this is the total profit area and as the movement we keep on going up that profit goes on and happening.

So, and this region if you talk about, finally if you take this connect this region, this region is called as the margin of safety region, this region is called as the margin of safety region because after this once you have cross a breakeven point whatever the production you make beyond this point that is called as the margin of safety area and what, how we have define the margin of safety? Total sales minus sales at the breakeven point, so this is the total sales line and this is the breakeven line.

So, from this to this whenever the sales are going to take place this area is called as the area of the margin of safety. So, we have already discussed means almost all the things, here one

important thing left is that is the angle of incidence. Now, we are calling this angle because it is becoming angle here and we are calling it as a angle of incidence, what kind of incidence? Means the incidence of profit, angle of incidence of profit.

So, we normally write it as the angle of incidence, so basically it is angle of incidence of profit and how? Means the incidence of profit will be higher if the gap between the cost line and the sales line is quite high. For example, if you increase or able to increase this gap that up to certain point of time total cost is more than the total sales and after crossing the breakeven point the total cost line means remains the lower than the total sales line and if the gap would have been these two lines.

If you talk about this gap if the gap between these two lines is means as much as possible angle of incidence of profit will be that much bigger, right. So, how apart they are from each other these two lines angle of incidence of the profit will be that much because the cost is very much under controls, sales are going up, so it means after recovering the sales level or reaching at the sale level which is called as the point of breakeven.

So, after that if the gap between the cost and the sailing price is very high, so incidence of the profit likelihood of the profit, earning the profit is very high. So, it means this is the total chart which is called as the breakeven chart, breakeven point chart or cost volume profit analysis chart, cost volume profit analysis chart because we are taking care of the cost also, we are taking care of the volume of the production also in terms of the value and in terms of the units and we are taking the concept of the say, profit also that how much profit is going to be there.

So, you call it as CVP chart cost volume profit and analysis chart, you call it as the breakeven point chart but we are able to understand so many things, that how in the marginal costing, the two costs are segregated, fixed costs and the (big) variable cost, how then sales start going up, how the cost start coming up and initially the cost remains higher as compare to sales, we reach at a point of intersection of the two lines and here these two lines are called as the say point which is the point of the no profit or no loss we call it as the breakeven point.

And after that, means the gap is that is the between the cost line and sales line, so that gap bigger the gap higher the gap, more the gap is angle of incidence of the profit is likely to be there otherwise it is not going to be there and if the it is gap between these two lines is lesser so angle of incidence of the profit is that much less, right. So, we have to increase the gap, we

have to control the cost you cannot control the fixed cost but at least you can control the variable cost.

So, you have to control the variable cost, you have to keep the fixed cost under control and this gap between the two lines have to be significantly higher, the movement it goes up or start increasing angel of incidence of profit becomes bigger and likelihood of earning the profits by the firm goes up. So, this is the chart I think you will be very clear now to understand then what is this chart of the breakeven point chart, I did not show it on the PPT to you, I prepared it myself here, so that you can understand that how we prepare this chart, what is the meaning of this chart and how it is helpful in the important decision makings by the management of the different companies, different organizations, right.

Now, after this means the conceptual discussion or the basic discussion, now we will start talking about the certain problems, right. I told you that after discussing the basic concepts of the marginal costing, techniques of the marginal costing and explaining you about the relevance of the marginal costing and knowing about different formulas and models, that how different concepts can be worked out under marginal costing for the important management decision making.

Say, what is contribution, what is cost volume profit, this what is the P/V ratio, what is this cost volume profit analysis, what is breakeven point and how to find out the level of say sales to earn a desired amount of profit, how to calculate the contribution, how to calculate the variable cost, fixed cost. So, it means all those things we discussed conceptually and learned the formulas and then I give you one important thing there is a most important thing you should keep in mind always as a student of marginal costing and the management accounting that the marginal cost equation, marginal cost equation S minus V is equal to F plus P, right.

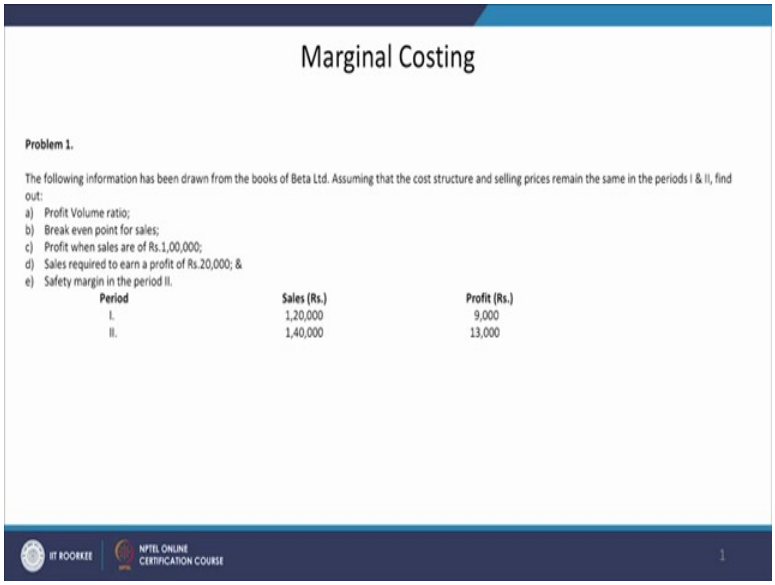
So, this is basically the crux of the marginal costing, sales minus variable cost is the contribution and contribution should be equal to or maybe as much as higher if it is possible, it should be at least equal to the fixed cost plus the profit. If the contribution amount is very high there is a gap between the sales and the variable cost is very high then what will happen? Fixed cost remaining fixed, you would be increasing the possibility of earning more profits.

So, that if that means marginal cost equation is very, very important and we have to keep that equation in mind. The relevance of that equation is that for example, if you know any of the three things fourth can easily be worked out, right. So, this is a basic conceptual and initial

discussion on the marginal costing. Now, how to implement those different techniques for example, we talk about the contribution you talk about the you are say P/V ratio or the say breakeven point or the margin of safety, how to make use of means these different subcomponents of the marginal costing in the management decision making.

Let us discuss some problems, I have brought a problem sheet here, it is fixed here, it is attached here. So, first we will understand what is the problem, what is required to be done then we will go for the calculations and then when I will do the calculations here and calculate certain relevant values will be able to understand that how the marginal costing is useful in the say, day to day management decision making, right.

(Refer Slide Time: 13:37)



So, now let us discuss these problems and I will first take it you to this sheet, this sheet is say having the initially we are I have got the four problems for you but I will give more problems also, we will add the one more sheet also, so that most of the concepts of the marginal costing can be covered here by solving the different kind of the problems, right.

So, because I discussed with you that say in the with the help of margin costing you can decide the products makes you can, say find out the pricing you can go for the pricing of the products, you can take the say, decision with regard to the limiting factor or you can try to find out that say, what is a contribution, what is a role of the contribution and how to take decisions with regard to different products and services in the organization by using the concept of say marginal costing, so these are some of the problems, relevant problems.

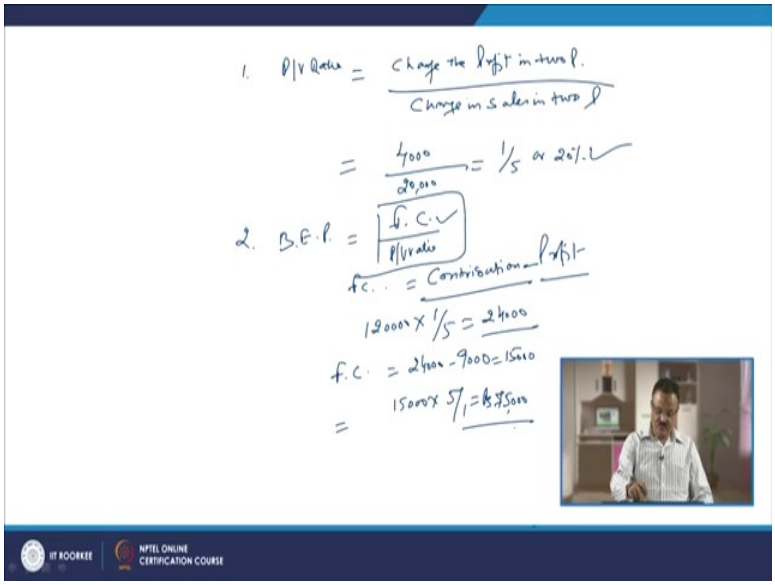
We will start with very simplest problem and after that we will move to the say higher level also, but the concept here is that how to make use of the marginal costing in the day to day management decision making, right. So, for example, this is a first problem given to you here and this problem is, the following information has been drawn from the books of Beta Ltd. it is a company Beta Ltd.

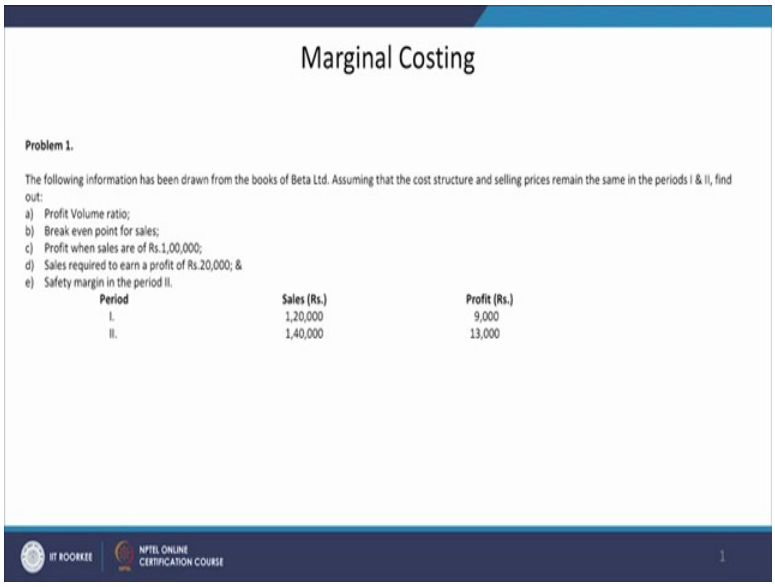
Assuming that, the cost structure and sailing prices remain the same in the period one and two, assuming that the cost structure and selling prices remain the same in period one and two, so this information is given to us, we are given the period one, period two, we are given the information about sales, we are given the information about the profit and sales in the period one are 1,20,000 and profit is 9000 and sales in the period two is 1,40,00 and profit is 13,000, right.

So, now we have to find out certain things, first we have to find out where asked to that you have to find out, what is we have to find out here? Profit to volume ratio, P/V ratio first of all we have to find out then we have to find out the breakeven point for sales, breakeven point for sales and then we have to go for profit when say sales are of rupees hundred thousand that is 1,00,000 rupees that, how much profit will be there? We will have to find out that profit also when the sales are say 1,00,000 rupees and then (d) sales required to earn a profit of rupees 20,000 and lastly we have to find out is the safety margin in the period two, right.

So, we will have to work out these, say five things from this information given, these information given is very simple not much things are given to us, what I think these information is very useful to answer these all five questions. So, let us do it and understand that how to answer these questions, right. So, now first question is there first of all we have to calculate the P/V ratio.

(Refer Slide Time: 16:25)





This is required to be done that is the profit to volume ratio. Now, if you recall what formula I gave it to you to calculate the profit to volume ratio? I gave you the formula that profit to volume ratio can be calculated fast in a very simple manner that is the contribution to be divided by the sales, right there is a one formula I gave it to you, if that information is not available with regard to the say, for calculating the contribution then you can use the second form of the formula.

There is a fixed expenses plus profit divided by the sales means fixed expenses plus profit is also the contribution is also the definition of the this contribution. So, you can calculate the P/V ratio that way also or if both the things are not possible to be done then the third method I told you that you have to use the concept of change in profit or contribution in the two

periods from period one to period two divided by the change in sales from the period one to period two.

So, I think whatever the information given to us, here it is we are given the information about the sales, in the period one, profit in the period one and we are given the information about the sales in period one and sales in period two and profit in period two. So, I think we can easily calculate the P/V ratio, so I will use the formula here, change in the profit in two periods, change the profit in two periods divided by the change in sales in two periods, right.

So, you can easily find out change in the profit in two periods is, how much is the profit in the period one? This 9,000 and how much is the profit in the period two? It is 13,000. So, what is the difference between these two, change in the profits in two periods from 9,000 to 13,000, so this is 4,000 rupees and change in sales is how much if you go back? Change is sales is 1,40,000 it has become in the period two from 1,20,000 in the period one.

So, that change in the this sales is 20,000, right so you can easily calculate this ratio and this ratio is you can call it as 1 by 5 or 20 percent, 1 by 5 or 20 percent. So, you can understand the profit to volume ratio here is 20 percent. As the volume of production increases, we keep on manufacturing and selling more in the market you will be means possibly increasing the profit by 20 percent.

So, means it is quite likely that means, we are able to earn about 20 percent of the profits. So, you can say from the total sales price 80 percent will be the cost and the 20 percent will be the profit. So, likelihood you can say broad, this is not exactly like that but broad idea you can have from the profit to volume ratio that what is the say the relationship between the profit and volume and here we are found out that P/V ratio is 20 percent, so we have answer the first question.

Now, the second question here asked in this case is what? Let us go back to the sheet, breakeven point for sales, breakeven point for sales or the sales at the breakeven point, right. We have to find out the sales at the breakeven point, so let us go for calculating the sales for the breakeven point, so what is a formula of the breakeven point?

If you talk about the breakeven point is a formula for the breakeven point is, say breakeven point formula here is, fixed cost divided by if it is to be found out in units then the formula is selling price per unit minus variable cost per unit or it has to be found out in the form of value of sales then you can use the formula and that formula is F multiply S divided by S minus V

and if these two formulas are not means, we are not comfortable to use then the third formula is fixed cost to be divided by P/V ratio, fixed cost to be divided by P/V ratio, profit to volume ratio, right.

So, now we are not given the even the fixed cost also, we are not given even the fixed cost also, so we have to first find out the fixed cost or the fixed expenses and what is the way to find it out? The fixed cost is equal to contribution minus profit, contribution minus profit is the way to calculate the fixed cost because when the total contribution we have to cover up both fixed cost also and the profit also.

So, if you want to find out this information then contribution to fixed size but here we are given the information about the profit but we are not given the information about the contribution, so again this is a question that how to calculate the contribution? If you are not able to calculate the contribution, you are not able to calculate the fixed cost. So for calculating the fixed cost you have to first calculate the contribution and contribution is not given to us, so we will have to calculate the contribution also.

So, the contribution you can calculate here easily, that is the sales in the period one, how you can calculate the contribution that sales in the period one if you multiplied by the P/V ratio that is 1 by 5 sales multiplied by the P/V ratio, so that amount will give you, that amount will come here as 24,000 is the, rupees 24,000 is the contribution, rupees 24,000 is the contribution.

So, to calculate the fixed cost now, I think we are able to go ahead, contribution here you have found out it is that is 24,000 and profit we also know, which area we have to find out? Breakeven point for sales, so we are going to calculate the breakeven point for sales for the period one and if you calculate the profit for the period one, it is how much? It is 9,000. So, what is now the fixed cost? Fixed cost is going to be rupees 15,000, fixed cost is going to be now 15,000.

So, now you can I think find out easily you can find out the, what we required here? We required here in this formula, fixed cost divided by the P/V ratio, so we have got now the fixed cost also, we have already calculated the P/V ratio, so finding out the B.E.P. will not be a problem, so what is the B.E.P here? fixed cost with us is that is 15,000, right and if you divided by 1 by 5, so it will become 5 by 1 here, so if you multiplied by this so 15,000 multiplied by 5 by 1 it is rupees how much? 75,000, it is rupees 75,000.

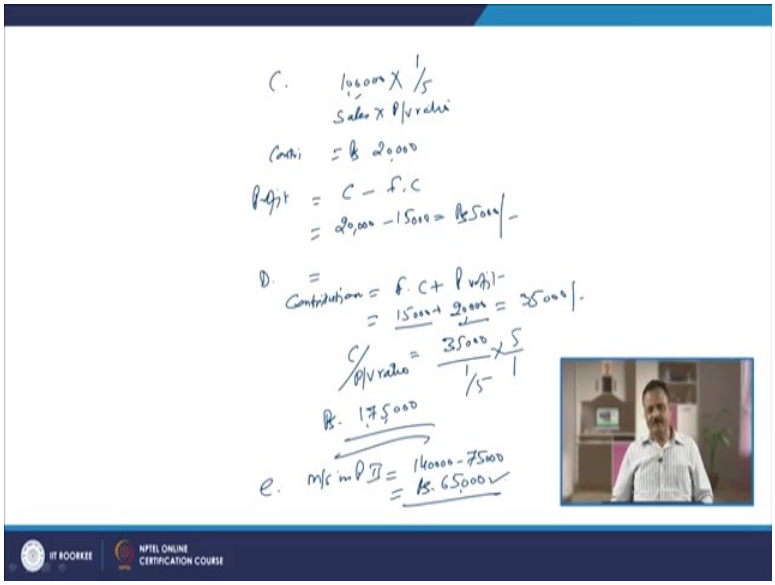
So, you can say breakeven sales here in this case are 75,000 rupees that out of total sales of 1,20,000 rupees out of the total sales, expected sales of 1,20,000 rupees breakeven sales are how much? The 75,000, after attaining the sales level of rupees 75,000, we will be at the state of the no profit no loss. After that, when the sale will start moving from the 75,000 towards the 1, 20,000 then we will be, say earning the profit so we will start earning the profits.

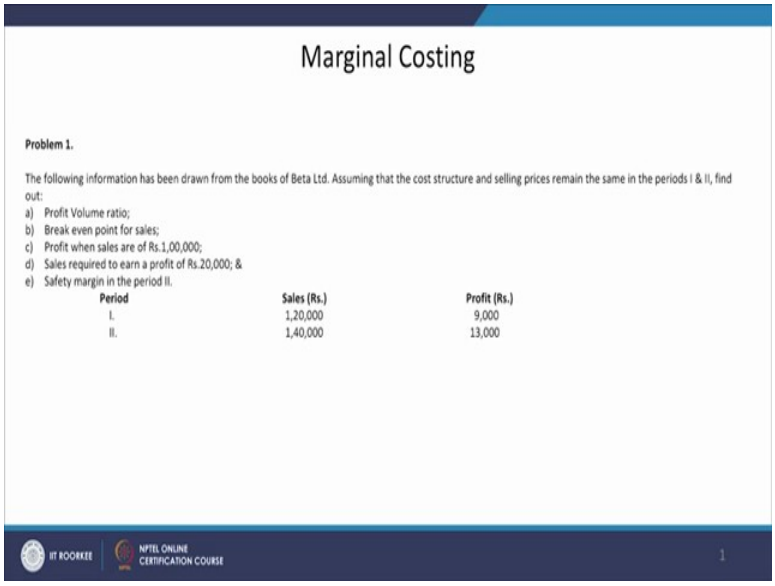
So, in this case, say the breakeven point we have calculated is 75,000, if you calculate the breakeven point for the second period, period two where the sales are 1,40,000 and the profit is 13,000 again the same breakeven point will come because change in the sales and change in the profit is almost the same.

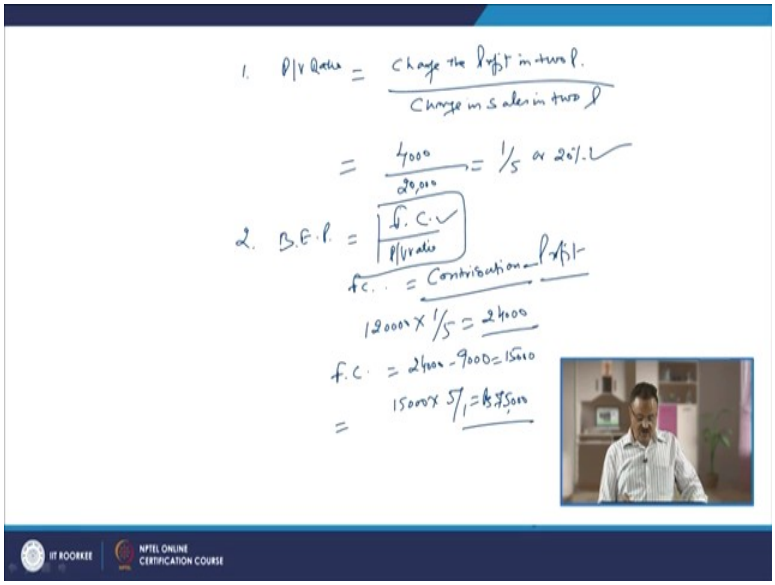
So, you will again, you can calculate the B.E.P for the period number two for that first you have to calculate the fixed cost then you have to calculate the contribution and then calculate the fixed cost and then applying this formula of the fixed cost divided by the P/V ratio, you can find out the say, breakeven sales for the period two, right so that is to you assignment you can do it yourself.

Now, we will go for answering the third question and third question is what? Profit when sales are of rupees 1,00,000, profit when sales are of rupees 1,00,000, so it means in this case again we have to find out the amount of the contribution, right. We have to find out the amount of contribution here and if you try to find out the amount of contribution, how you can find out is? That contribution at means we have to look it at, what is the amount of the contribution? So total cost is going to be the variable cost plus the fixed cost and profit when sales.

(Refer Slide Time: 25:20)







So, first of all you have to calculate the contribution, contribution ratio you can say though for calculating the contribution ratio, it is the (c) part we are calculating. So, what you can do here is, that is the, what are the total amount of the sales we want to earn? Know, that is the 1,00,000 rupees, the sales and profit when sales are 1,00,00 rupees and you have to multiplied with something that is the with this P/V ratio, P/V ratio is 1 by 5.

So, the amount of the sales to know the desired amount of the sales you have to multiply those sales by the P/V ratio, so you can say here as the sales multiplied by the P/V ratio, so you can find out that what is the P/V ratio here? 1,00,000 into 1 by 5, so this becomes rupees 20,000, right. So, this is the amount of the contribution we have already found out and from this contribution now, this is the amount of contribution coming up from the sales of 1,00,000 rupees.

So, from to find out the profit, first of all you have to find out the contribution from the desired amount of the sales and desired amount of the sales is 1,00,000 rupees, contribution where we calculated here multiplying that desired amount of the sales by the P/V ratio we found out here that the contribution is 20,000 and already you have found out something that is called as the fixed cost.

So, profit is basically how you can find out? Profit is basically you can find out is contribution minus fixed cost, so what is the contribution here? Contribution here is 20,000 and fixed cost is how much? We have already calculated, what is the fixed cost here? That is the fixed cost amount which we are calculated here is 15,000, right so the 15,000 to means 20,000 minus 15,000, so the profit is rupees 5,000, profit is 5,000.

So, it means because we have already known it that when you are going to have the sales of 75,000 rupees, we are at the breakeven point, total sales are 1,20,000 rupees, so if you want to earn a profit of 5,000 rupees, what should be the level of sales you can ask? Answer this question, this way also or if the sales reach at the 1,00,000 rupees then what will be the level of the profit at that time?

So, we simply because we know the (contri) P/V ratio profit to volume ratio, because for a given level of the volume 1,00,000 is the volume for given level of the volume of production multiplying it by the P/V ratio you can find out the level of contribution, right. So, contribution we are find out is 20,000, fixed cost we have already found out is the 15,000 and

now the profit at the level of 1,00,000 lakh of sales, so what was the question here, the question was the profit when the sales are 1,00,000 rupees, so the profit will be 5,000 rupees.

Next question we have to answer here is that is the, sales required to earn a profit of, sales required d part we have to find out that, sales required to earn a profit of rupees, how much? Profit of 20,000 rupees, sales required to earn a profit of 20,000 rupees, so we have to calculate these sales required a and the profit of 20,000 rupees. So, you can find out here that, we will have to start with the first thing.

First of all you have to calculate the contribution here, so what is the contribution for this? You have to calculate the contribution, contribution is the fixed cost plus profit, so for this part contribution is the fixed cost plus profit. So, if you find it out fixed cost plus profit, what is the fixed cost here? 15,000, what is the profit we have calculated? Already, means if you talk about the profit here, the profit is 20,000, the profit is 20,000, sales to earn a desired amount of the profit of 20,000 rupees.

So, the fixed cost is this and this is the profit. So, from the contribution, what you want to recover? You want to recover two things, fixed cost you want to recover, profit you want to earn as the 20,000 rupees, so total contribution has to be 35,000 rupees, it has to be 35,000 rupees. So, it means you can say the your question is, what do you want to find out? Sales required to earn a profit of 20,000 rupees, so you have found out the contribution here.

And for finding out the sales, what the formula you can use it? That the sales contribution divided by the P/V ratio, divided by the P/V ratio, so contribution is 35,000 and divided by the P/V ratio, so P/V ratio is how much here? P/V ratio is you can say 1 by 5, so you will be making it like this 5 by 1, so this will become how much rupees? 1,75,000 rupees to earn a profit of desired amount of 20,000 rupees we have to take the level of sales and that level of sales is going to be 1,75,000 rupees.

If you make the 1,75,000 rupees then you are going to have the profit of, how much? That is 20,000 rupees and last I want to (ask) answer this question is, margin of safety in period two, margin of safety in period two. So, simply the formula is that is a sales in period two and minus breakeven sales, sales in the period two, so what are the sales in the period two? 1,40,000 and again if you calculate the breakeven point, I told you then it will come out as 75,000 rupees.

So, this amount is going to be how much? Margin of safety is going to be 65,000 rupees, right. Because up to 75,000 rupees we will be at the point of no profit or no loss and after that whatever the sales we make up to 1,40,000 rupees that will be the margin of safety and that amount is the 65,000 rupees. So, this was some basic, say concept, basic example which I discuss with you.

We started means doing some problems in the marginal costing and learning about how we can implement the concept of marginal costing and in the next class, I will come out with some problems to answer the different questions which can be answer with the help of the marginal costing and then we will learn more about this concept, thank you very much!