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SUMMARY KEYWORDS

superconductors, profit, function, revenue, equal, ts, q minus, squared, price, cost, quantity, transport, multiplied, write, maximize, produce, question, price times quantity, simplify, inverse demand function

SPEAKERS

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Hello, everyone. Welcome to our video on working with functions. We're creating composite functions. So we're combining functions, we're going to work on an example where we're going to combine a revenue function with a cost function to create a profit function. After we've done that, we're going to use Excel to try and figure out how much money our company can make, which is to say, how can they maximize their profits? I hope you're ready. If you are, keep watching and we'll get started.

Take a moment to read the question in front of you. We've got a firm by the name of TS, and they're selling superconductors. And the quantity of superconductors that they sell is going to be dominated with the unknown variable Q, the price received from the sale of a superconductor is P of Q, it's a function P of Q. And it can be defined as 100 minus a third times the quantity produced. The price to produce one superconductor is C of Q. And C of Q is equal to this expression here, which is 20 plus one over five times Q. The first question is asking us to combine this into a profit function. So remember, that profit can is always going to be equal to revenue minus cost. At least in its most simple basic way, it's revenue minus cost, we can throw in taxes to talk about profit, net profit, gross profit, but profit in general, in its most simple form is going to be equal to revenue minus cost. Now here, revenue is not given to us, we're given what we learned in an earlier video was the inverse demand. This thing right here, we could call that inverse demand or the inverse demand function. But if we want to find revenue, revenue is often equal to price times quantity. So what's the price? And what's the quantity we multiply them together and we're gonna get revenue.

So you can see that in our profit function right here, we've got P times Q. And another way to write this profit function that could have been written as P of Q is equal to P price. Notice price is a function of Q, like so multiplied by Q minus C of Q. So the revenue function, this symbol here is pi, pi of Q is equal to P of Q times Q minus C of Q. Now let's go ahead and take our P of Q function and our C of Q function and plug them into the profit function. We're going to get P of Q is equal to 100 minus 1/3 Q, that whole thing, that's our P of Q, from up there, is going to be multiplied by Q. And we're going to subtract, minus our cost function, which is 1/5 multiplied by Q. Now we could simplify this a little bit. And if we do that, we're going to find that we have 100 Q minus 1/3. Q squared minus one over five

Q. I can keep simplifying. Notice that one over five, one over five is equal to 0.2. So I could add these two like terms, and we could end up with 99.8 Q minus, well, I could write this as Q squared over three. Now I'll adjust the screen so you can see the entire answer.

Now in the next part of our question, we see that not only does the company TS have to pay for the production of the superconductors, they also have to pay for their transport. And we're told that the transport cost V is an additional 20 cents. So we could write this sort of additional cost function, or transport cost function as VQ is equal to 0.2 Q, or one over five Q. How does this affect the profit function? Well, our profit function, pi of Q is going to be equal to P of Q times Q minus C of Q, minus V of Q and that's going to give us 100 minus a third of a Q, all that times Q minus one over five Q minus another one over five Q. So the costs of producing superconductors essentially doubled once we include the transport cost.

Simplifying this and if we simplify this, we're going to get 100 Q minus Q square over three minus two or five Q. And our profit function is going to be 99.6 Q minus Q squared over three. Now the last part of our question down here, part C, asks us to use Excel to see if we can find the profit and profit maximizing quantity Q. So how many superconductors should the firm TS produce to maximize their profit? First, if they have no transport costs, that's what we had in part A. And then in part B, how does the optimal Q, the profit maximizing Q, change when we introduce transport costs.