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SUMMARY KEYWORDS

revenue, equal, solve, marginal revenue, x naught, equation, naught, squared, p naught, units, indefinite integral, antiderivative, initial condition, skiers, integrating, ski resort, gave, integral, $x \, dx$, correspond

SPEAKERS

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Welcome. In this lecture we're going to go through an example of solving for the constant in an indefinite integral. So recall, so, the indefinite integral. So recall how we do an indefinite integral. So you want to take the integral of F of $X \, DX$, right, then what do we do? So we get the, we have the antiderivative, and then right, so this is the antiderivative. And then the calculus professor will tell you again and again and again do not forget your C right? So, don't forget you must solve for this. Must solve for.

Okay, so let's kind of do this. So here's the setup for an example. So, so here's our example setup. So we're going to suppose that we have, we're going to have that the marginal revenue, so the marginal revenue for a ski resort is, and this is going to be given by $M \, X$ is going to equal 50 minus so this is point $01X$. Okay, and so this is the, right, this is the marginal revenue that's given like that. So that means that we've got here, so this is $M \, X$ is going to equal the derivative with respect to X of the revenue. Whatever this revenue is, okay. So then that's the first thing we have and we have that at, so at $\$50$ per ticket the ski resort will have 2000 skis. Sorry 2000 skiers. Okay? And then the task is going to be, and we'll kind of break down a little bit more, but first let's look at what the task is. So our task is going to be. So it's going to ask what is the revenue equation?

And like more generally, so the revenue, and I'm not using red in the same sense as over there at the moment. So the revenue equation in general, so this is going to be equal to, so this is R if X , which is going to be $P \, X$ where this is the price and this is the units okay? So the fact that we have $\$50$ per ticket is going to give me, so we'll call that like this is a particular value. This is going to be 50 . And then the fact that we have 2000 skiers so this is like our our unit, so X naught, right, this is 2000 units. Okay? So we have like a particular value there, and so then you can kind of ascertain from those, right? What, like our R is at that particular moment. So that's going to be our initial condition. But let's just get started with all of this. I think I put down everything I wanted to. So here's our, we'll get started with the solution. Okay, so the first thing in here we're going to have, so we have R of X is

going to equal, so the revenue is going to equal the integral of, right, we have this function and $M \cdot X$, so $M \cdot X \cdot DX$, which is going to equal the integral of, and then we have a formula here for that. So this is going to be 50, and then minus point 01X, and then DX.

Okay? so just integrating here, we're going to have that the revenue is going to equal, so I'm going to have $50X$, and then I'm going to have minus, so now I have $0.005X$ squared, and then I have plus C that I'm going to need to solve for. Okay, and let's call this equation that we have here star. Okay, so let's keep going. So that is like the first and then we're going to go up and over. So the next step in this is that we need to use our initial condition, so we're going to use this initial condition where it's just some particular time that you know your values, the corresponding, the way they correspond to each other. Okay, to solve for C.

Okay, well, we have this right, we have this X naught, and this P naught. And we know, right, how to get the revenue from that. So we have that, right, so we have X naught equals, and then we have that that's 2000. Right? And we have that P naught equals 50. Which tells me right that I'm able to get my revenue, right? So my revenue at X zero units is going to equal, well I know that's P naught times X naught. So that's going to be 2000 times 50, right? Which is then just going to equal 100,000. So this is going to equal 100,000. Okay, so now I can kind of use this. So I have that this is going to equal 100,000. But I also know right, that so R of X naught is going to equal, well, I have, I'm going to start doing this in a different color, start doing this in orange. Okay, so we have that this R of X naught is equal to 100,000. Okay? But I also have, so R of X naught is going to equal, so it has to be 50 times X naught, and then we've got minus, right, I'm just putting it into the equation for R of X naught that I have over here. So I have minus 0.005 times and then I've got again this X naught squared plus C.

Okay, but I can also use this and the value I have for X naught being 2000. Okay, so what this is all going to give me is that. There we go. Okay, so I'm going to have that, so for I'm going to use my 100,000 from there, so I have 100,000 is going to equal so I have 50, and then I have this X naught is 2000. So 2000 minus 0.005 times that 2000 again, now it's squared plus C. Right? And now I have a whole bunch of numbers and just C, so I can actually solve for C. So this is going to give me that C equals 920,000. Right? Okay, so in the last step, so this is going to be step three is I'm actually going to be able to plug this back in, right, to my, my equation stars. So in this step. Okay, so now I'm in step three. Right? So in this step I just plug, so I'm going to plug C equals 920,000 into, and then I have this equation from that star up there. Where did it go? Here it is. So into, and then I just have into star, right, which is, and so what I'm going to get is I'm going to get that R of X is going to equal, so I have $50X$ minus $0.005X$ squared. And then now I have this plus C. So I have plus 920,000. Okay. And that's my final answer.

Okay, so let's talk about what we did here. So in our kind of setup, so really kind of the key in this was from everything we got, we knew that we're going to need to integrate the marginal revenue to get the revenue, but we ended up with this plus C. And we needed to solve for it. But there was a particular number of units that I also knew the price at, but then that also gave me the revenue at that number of units. So that gave me kind of a correspondence so that I could get, right, that 100,000, which was the revenue that I can get by multiplying those two values that I knew had occurred at the same time. So that I could get 100,000. And then I would just put this X naught into

the equation for the revenue. And then that gave me a way to solve for the C , which I could then put back in the equation for the revenue that I got by integrating, okay? A lot of times, I mean, initial conditions can come in a lot of different forms. This was just one of them, but it's like if you know how everything corresponds at a particular moment or at a particular value, then you can use that often to solve for your C and to get a particular function instead of a family of functions. Okay? So, I hope that made some sense and was helpful, and I will see you in the next lecture.