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SPEAKERS

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Welcome. In this lecture, we're going to go through a few examples of identifying when you're in a substitution situation, and actually how to see that you're in a substitution situation as in when you can apply the substitution rules. So first, I'm going to remind you of how the substitution rule works. So we have the substitution rule, which says, the substitution rule, right, which says that, if I have an integral, and then I have, so I have, right, this is a function where I have an inside function and the derivative, right, and then I need to have the derivative next to, next to it, right?

DX. And what I ended up getting is the integral of, so I have the integral of just this thing, but it's with respect to U. And we'll look at some examples of how to actually compute with this. And so in this one we're just going to identify where we're in that situation. And then we'll go through examples in future lectures. These are things that they, you'll get much more comfortable with them by just like working through examples, watching me work through examples, working through them together with me, and then doing them on your own also. So what I kind of described was that, and this is what you need to look for, is that this is the function on the inside this one here. So the function on the inside. And then this is the derivative next door. So the derivative next door was how I was describing it, or I've always described it. Okay, so let's look at some examples. And I think then it'll make a little bit more sense. So here's the first one, we're going to look at.

This is example one. And so if I had the integral of $2X$ divided by, and then I have X squared minus 1, minus 11 DX. Okay? So what is the inside here? It's actually down here. Okay? So let me kind of break this apart in a way with the colors that you can kind of see what I mean. So we're going to, this is going to equal and this is the integral of, and then I take 1 over, and then here's my inside function. Well, so this is, this is like having 1 over U, where my U is X squared minus 11. Oops my inside I'm supposed to be doing in red. I'm going to remember to do that to keep everything consistent here. So this is X squared minus 11. Okay, and then next door, right, what is, right, so the next door is actually this $2X$. Right? So looking at this, this actually works because this is the derivative of that, right? So you can actually kind of see, when you break it apart like this, a function is 1 over U, the U is X squared minus 11, and here's the derivative of U. Great. So let's do another example.

This is example two. So we're going to start out by writing, so we have $3E$ to the $3X$ cosine of E to the $3X$ DX . Okay, so looking at this, you might kind of see, here's an inside function and there's a derivative. So let's kind of rewrite it so that it's even easier to see that this is what we have going on. Okay? So this is the integral of, and then we have cosine, and then on the inside of the cosine, right, is this E to the $3X$? What is the derivative of E to the $3X$? We have to remember to actually use the chain rule on that. Also, there's kind of like a double chain rule here going on, but you can handle it. So this is actually going to be, right, so we do have that derivative, which is $3E$ to the $3X$ DX . I startled myself with dropping the pen, but that's okay. Okay, and let's look at another example here. Right? So this is again, here's the inside function, and there's its derivative. My outside function is cosine of U .

Let's do one more of these. And then there'll be more examples that are fully worked out. This is just kind of identifying what the situation looks like. So if I have the integral And I have $2X$ E to the X squared DX , okay? And then what I'm going to get. So now again, I want to write it so that it looks kind of like so my, here's an inside function to this outside function. So I have E to the, and then I have X squared. And then times and then right, so what's left is this $2X$. And that is actually the derivative of this, so this is a $2X$, right, DX . Okay, so in each of these circumstances, as we go through, as we go through to the circumstances, you can see I have an outside function with the inside function, and the derivative of that inside function is next door, sometimes you have to manipulate them a little bit in order for them to look exactly like that. But we'll not be going through too many very complicated examples, because this is really more about kind of philosophically almost understanding that the, that integration is the opposite of differentiation. And so if we had the chain rule, we would have some substitution rule. Right the chain rule for derivative turns into the substitution rule for integration. But we will go through some more examples. So I hope this was illuminating and made some sense and I will see you in the next lecture.