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SPEAKERS

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So welcome. In this lecture, we're going to introduce indefinite integrals. And these are going to be related to the antiderivative. So let's first recall how the antiderivative works. So let's recall antiderivatives. Okay, so let's first take the derivative. So I'm going to take the derivative with respect to x of, let's see, how many functions do I have in mind? I have four functions. I'm just going to write this all out ahead of time, because I do want to use color coding here. But I think it's easier if I first use one color at a time here.

Okay, so let's take the functions, let's do it this way, I'm going to do these in red, and then the derivatives will be in orange. So the functions that I'm going to want to take are, I'm going to take the derivative of x^2 , x^2 what am I doing to do, plus π , sorry, plus 1, then I'll do x^2 minus π . And then I will do x^2 plus C , doesn't matter what my constant C is. And in each of these circumstances, we're going to get the exact same thing, right? Because the derivative of a constant is zero, so I'm going to get $2x$. $2x$ Because the derivative of 1 is zero. $2x$ the derivative of minus π , it's a constant so it's zero, so I get $2x$. And the same thing with any constant, I get $2x$. Okay. So now if I move over to the antiderivative, so that's when I'm taking the derivative. So now let's move over to talking about the antiderivative. So for the antiderivative, I need to ask myself, oh, well, what is $2x$ the derivative of? Okay, so what is this $2x$ the derivative of?

Well, there's lots of answers, right? It's a derivative. We saw over here, it's a derivative of x^2 , wrong color. It's the derivative of x^2 . It's also the derivative of x^2 plus 1. It's also the derivative of x^2 minus π . And it's also the derivative of x^2 plus C for any constant C , right? And then we had in general, so generally, when we say the antiderivative we mean that, remember we talked about the generalized antiderivative where I put a plus C in there okay? And so the generalized antiderivative is, so what we actually write is that x^2 plus C is the, and sometimes we write generalized and sometimes we don't, is the generalized antiderivative.

Right? So then the indefinite integral of $2x$, so what this all is going to tell me is that the indefinite integral of $2x$ is, so this is how we would write it. And maybe I'll use the derivative we did the

integral of $2x$ is, so this is how we would write it. And maybe I'll, we did the derivative we did the antiderivative and then the indefinite integral down here. So what is this? This is going to be the integral of $2x \, dx$, right? And what is that? That's actually going to equal precisely that generalized antiderivative. Okay, so that's how you find the indefinite integral, you just take the generalized antiderivative. So that plus C is important. Okay, and then I'm going to say convention. Okay, when a formula for a general indefinite integral is given, it's only valid where it's defined.

It's only valid where it's defined. Okay, so for example, we have, so here's example one. So I'm going to take, so we write the integral of 1 over x cubed dx is going to equal minus $1/2$, 1 over x squared plus C . Okay? Even though it's only defined on intervals without zero. Okay, and then my second example will be the integral of 1 over $x \, dx$ is going to equal the natural log of the absolute value of x plus C . Okay? And then the last thing I'm going to tell you, so these are just two examples. Sometimes you're going to be able to know what the antiderivative is, but a lot of the time, find an integrable table to look at, we're going to teach you how to compute some of these that aren't as obvious. But the key point is just finding an integral table to use for reference. So this is homework for you, find an integral table to use for reference.

Okay, so the, we're introducing something that we've been building up to, and so it should seem very natural, which is that, in this case, the only difference between, and we'll talk about this a little bit in the next lecture, the difference between this and the definite integral, which we looked at before. In the definite integral, we had an interval that we were focusing on, right? So like, when we were looking at the area under the curve, we only looked at it between two x values, and that was our interval when we then put it into an indefinite, or definite integral. For the indefinite integral, I don't have bounds. And so I have this C . So this is actually my output is a family of functions. And I'd have to actually have some kind of initial conditions or something in order to solve for that C . Otherwise, I need to leave it in this general form. Okay, so thank you, I hope that's helpful, and I'll see you in the next lecture.