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antiderivative, derivative, function, natural log, sine, work, problem, constant, $3x$, put, compute, minus cosine, chain rule, fact, linear, anti derivative, cosine, differentiation, caution, minus sign

SPEAKERS

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Welcome. So we've learned what antiderivatives are, and we know that, right, as in, there's something that when you differentiate them, you get a function. The problem is, is, you know, sometimes it's actually a little tricky to figure out how to compute them. Or you have to do a little bit of guesswork. And so we're going to kind of go through a few of like, kind of the tools and rules so that we can actually compute them. So let's get started. So here's an important fact. So important fact.

Okay, and this is, and again our antiderivatives tend to be red. So antiderivatives are something called linear. And I'll show you what I mean by that. So antiderivatives, where the process sorry, anti, this is not what I meant write. I meant to write antidifferentiation. So the process of taking the antiderivative is something called linear. Okay, so anti differentiation, it's kind of a linear process. So, what does this, this mean? Okay, so let's say that I have, so I have, let's say that we're going to have that F of X . Okay, so suppose, suppose we have, okay, so F of X is the antiderivative, right, of some function F of X . Oops, it should be rounded, of F of X . And then we have that, so we have G of X is the antiderivative of, there it is. Okay, so this is the antiderivative of little G of X . Okay, so suppose that we're in this setting, right, then we're going to have, so there's going to be two things that we're going to kind of have. So we'll make a chart here. So I'm going to have the function and the antiderivative. So function and the antiderivative.

Okay, so the first thing that we have is that if I put a constant in front of, so now I'm just going to, I'm going to put a constant in here. So I'm also going to use pink for that. So if I put a constant in front of my function F of X . And I take the antiderivative, that constant is going to sit out in front, right? And that kind of makes sense, because if I took, you know, going the other way around, when I take the derivative, I can pull out the constant. So that should work out nicely. The other part of it is that, if I have F of X plus G of X , so I have f of x and then I add G of X . Right, and these are the functions where you, you just add the outputs. This is a new function where you add the outputs. Then I'm going to get, I'm going to get the antiderivative of F of X plus this antiderivative of G of X . Right, and these work well because you know going the other way, I need to know that when I take the

derivative, I get that when you take the derivative, I get that but differentiation satisfies these properties very nicely. So it kind of works the other way around. So now let's, let's look at some kind of other examples and rules. So other examples and rules.

Okay, so let's kind of again, make a chart. So I'm going to have the function and then the antiderivative. So I'm going to have the function over here, and then I'm going to have the antiderivative over there. So we were making them, initially we were making these red, if I recall correctly. So antiderivative. So what happens if I have the function X of N and we do not want that N equals 1. So my function in the first one is going to be X to the N , okay? Then or minus one, I think is what I didn't want it to equal. So this is N does not equal minus 1. Okay so it's not 1 over X . Okay, then the anti derivative is going to be one. And also from looking at the antiderivative, you can see the problem if n was minus one, that would create zero on the bottom there. Okay, so we get X to the N plus 1 Okay? So this is kind of like, right, this cancels out the fact that right, if I take the derivative of this, I have to multiply by N plus 1 and then get N to the N there. And so then I end up with N plus 1 over N plus 1. So that kind of works. So let's look at another one. So this is what actually happens with 1 over X . I'm going to put some lines in between these. So what actually happens with 1 over X ? Strangely enough, you get the natural log of X , so you need to take the absolute value there. And then you're good. Okay? Right, because it doesn't, you can't put negative numbers into the natural log. And then we have. So if we have E to the X , it's itself, right, we know this. So if I have E to the X , its antiderivative is E to the X , we talked about that a little bit two times ago.

And then if we have cosine of X , then its antiderivative is sine of X . And for each of these, you can check that if you take the derivative of what's on the right, you actually get what's on the left, right, that's exactly what it means to be the antiderivative. And then the last one is if I have sine of X here, right, that I end up with a minus cosine of X to compensate for there was a minus sign when I took the derivative of cosine of X . It gave me minus sine of X , so I need minus minus there, right? Okay, so these are some ones, they're something to be very cautious about. Right? So here's kind of a caution. Which we talked about a bit before, which is that, right, these only work if there's nothing on the inside, okay? So these only work if there's nothing on the inside, right, replacing X . So only work if there's nothing on the inside replacing X . Right? Like if it was E to the $3X$, this is not going to be E to the $3X$, right, and it's because of the chain rule. Right? You have to undo the chain rule, and that will be substitution. We'll see that at some point. Okay, so let's use a caution. Don't don't do these unless they're actually X there. But for those they're going to be useful, and then we'll give you the tool to use if you do have something on the inside. Okay? So, I hope that made some sense and I will see you in the next lecture.