

PfaffModule5L04

Wed, 2/2 5:24PM 11:02

SUMMARY KEYWORDS

derivative, function, equals, tangent line, cosine, slope, sine, f' , point, natural log, stick, wave, mind, graph, $\ln$, inverse function, circumstance, remember, remind, axis

SPEAKERS

Catherine Pfaff

Welcome. In this lecture, I want to just go through a few different kinds of good derivatives to know. And I'm going to do them with the actually kind of with the graphs, the functions and the tangent lines, and so on. So that all of this is connected up in your mind. Okay? So the first one I want to go through is going to be, so let's label it's always good to label our axes. This is X , and this is Y . And I want to look at the function F of X equals E to the X .

Okay, so this is the function that we're looking at. The graph of this function looks like, like this. Okay, so this is the graph of Y equals E to the X , that's the graph of this particular function. And then, if I look at a particular point A , right, and so I'm also looking at the slope of the tangent line there. Right? This is my tangent line. Right? So what is the slope of this, so the slope of this we're going to kind of go through this with each of these so that this will hopefully kind of imprint in your mind. This is going to be F' of A equals E to the A . Okay? So if I wanted to know the derivative at that particular value A , I would take E to that A , so if this was 3, that would be E cubed, okay? And then, so the derivative of this function, which is E to the X is actually itself. Okay? So remember that this is the function, right? So another way to write this is that F' of X equals E to the X . So the derivative function is actually the same function as the original function. So that's a very special function. Okay, so now we're going to go through and do another one. So kind of similar, or the inverse of this function, actually, I shouldn't say similar, but somehow in the same category of things that we look at. That's E to the X , and we also have, we're also very interested in the function, which is F of X equals the natural log of X .

Which is the inverse function to E to the X . Okay, so that's what we're looking at. And the graph of this one, right, we should get this by reflecting across the X equals Y . And so it's going to look something like this. So this is Y equals the natural log of X . Okay? And then if I wanted to look at a particular point A . So an input value is A , and I have a derivative at that point. Right? This would give me the slope of the tangent line there. Okay, so the slope of this is going to equal this F' of A which in this circumstance, what is that? It's actually equal to 1 divided by A , so that's the derivative at A , okay? So in line with that, is that this derivative, so what is the derivative function that we get when we take the derivative with respect to X of the natural log of X ? The derivative function we get is 1 over X . Okay? And so this would be, maybe I'll write this again notationally, like that. So this is saying

that my F' of X when my F of X is the natural log of X is equal to $1/X$. So that's a function and I stick in A and I get $1/A$, which would you give me the slope at this point, right here. Okay? And maybe let's even kind of point out what is this point here? It's good to remind ourselves of this a lot of times because we often get confused by this. That this is $A \ln A$, that point there, and maybe we'll do the same thing here, notice that's where the tangent line goes. And hopefully, when somebody asks you a question, they say, like, at the point, or at where they're going to tell you whether they mean at this A value or actually at this point, and this is A^e to the A .

Okay, so and then the next one is going to be, our axes again. X axis and our Y axis. And this one's a little bit different. So this is $F(X) = \sin X$. A lot of times people in these courses skip over the sine of X and cosine of X function. I, personally am against that, because a lot of things, these have these wave motion to them a lot of things in life kind of have this wave with acting, whether it is a wave, there are lots of things that act like a wave, or whether you think of it as kind of a peak and trough scenario where things kind of go up and down a lot. Okay? So that's $F(X) = \sin X$. And then if I want to look at a particular value A , and maybe I will look over here I'm going to get, right, the slope here.

Okay, so the slope is equal to, right, is equal to F' of A , which is going to equal cosine of A . Okay? And this was the graph of maybe, I left that out here, this is the graph of $Y = \sin X$. What's the other information that we want to put on here, that particular point. So this particular point here is going to be A , and then it's going to be $\sin A$, right, because we've stuck it into the function. This is the graph of the function sine of A . And this tells me that the derivative function if I want to look at it, so I want to take the derivative with respect to X of the function sine of X . And I'm going to get out cosine of X . Right, I usually like to put parentheses here to avoid some confusion. And so that's to tell us that this F' of X is equal to the function cosine of X . Can we stick in the value A , then we, one thing that we get, right, that derivative that we get at A is actually going to be the slope of a tangent line at that point A sign of A , okay? And then we have $F(X) = \cos X$.

So we get here X axis, our Y axis. So this is $Y = \cos X$. And then we can say okay, so let's look at a particular value A and look at the derivative there. Maybe I'll choose my A to be here. It's okay for it to be a negative value. So this point here is going to be A , right, and then we stick it in our functions and we get out cosine of A . And then if we took the tangent line there.

The slope that we would get for this tangent line, so this slope is going to equal F' of A , which is going to equal minus sign of A . Okay? And then so that that kind of reminds us this is actually, if we take the derivative with respect to X , where this indicates to us that I take the derivative with respect to X of the function cosine of X . What am I going to get? I'm going to get minus sine of X . And remember that what this notation is telling me is that if I take, what is this derivative function here, it's the function minus sine of X . I put in the value A , and I get out to slope at A there, okay, when X equals A , okay? so what do we kind of go through this time? We just went through the derivatives for some specific functions. But I tried to, in each circumstance, kind of tie together all the different ways we think about this to help kind of stick these in your mind a little bit better. And so we have the, right, we know, so several things to kind of keep straight in your mind are, there's the derivative function, right? So, well, this one's a little confusing. This is kind of fun, the derivative of e^X is e^X . But let's look at one that's a little bit different. So the derivative of $F(X) = \ln X$

of X is actually 1 over X . That's a function, I stick in A and that gives me the rate of change at A , okay? Or, that would be the slope of the tangent line where my X values A . So at this point, A natural log of A . Okay, so I hope that made some sense, and I'll see you in the next lecture.