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derivative, f prime, function, input, limit, differentiating, slope, finding, equals, write, compute, talk, divided, sloppily, colors, lecturer, lecture, picture, called, change

SPEAKERS

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Welcome. We've been talking about taking the derivative at a point and that gives you the slope of the, you know, if you graph the function that gives you the slope of the, at that point. We even gave how to compute it. But what now we want to kind of talk about a particular function that will encapsulate kind of all those slopes, right, for all the different points at the same time, okay? So we've seen, so what have we already seen? So we've seen that, okay, so this is what we've already seen. You know, we've seen the derivative, right, which is the same thing as talking about the rate of change. Which is the same thing as talking about the slope. Right, we've talked about all these things at a point. So at a point, right, like X equals A or T equals A.

Okay, and the way that we did that was we took, right, so we took F prime of A is going to equal, that's just kind of our notation there, is going to equal the limit as H goes to zero of, and we have F of A plus H minus F of A, all divided by H. Okay, so this is this limit. There's all kinds of ways to compute it. And the picture that we have, and so you've kind of seen this picture, it's good to keep drawing the same picture. So we have this all straight in our minds, particularly when you're like kind of changing what's going on, so this kind of relation. So this is kind of like the X or the T or whatever your input variable is, and then we would have our output variable, which is much more reliably Y but it's not always Y. Okay, and then you have your function. Something like this, this might be, this would be like the graph of our function, right? And then we have some particular point A, that we would be looking at here. And then we would get the slope, right, which would tell you, right, so we kind of go up and we look here and this is like the slope here, or one way to think about it is, so this is the this is the slope at A, right? At A, which is also the rate of change of F at A, same thing of change of F at A, okay? And right, that's the same thing as the limit as H goes to zero of this, and we have this F of A plus H minus F of A divided by H. Okay, these were all the same thing and it was at a particular value A that was very important, okay, because, so now what is new?

Okay, is that we can use, I'm going to write this in, I think I'm going to do orange of what's new. We can use, that's a nice poppy color. So when F prime of A actually makes sense for every input A. Okay, so, so we can use this derivative at each point to define this derivative function A, so this is like our derivative function. Okay, and this is going to be a function and it's going to be F prime. It's going to go from the real numbers to the real numbers. So I'm going to kind of write it like this. That tells me it goes from the real, my inputs are real numbers, my outputs are real numbers. Okay? So let's kind of talk about what this function is, okay? So what is the value when I input X equals A? I'm going to keep on rotating through colors, I kind of like doing this here. Okay, so what is the value when I input X equals A?

Okay, well the answer is that I'm going to get something and get F prime of A, which is again, that limit. Okay? So when I input A, I get what I've already defined as the derivative of A, okay, so that tells me what the function is, I just needed to know the input or the output for each input, okay? I input A, I get out that derivative at A, okay? And this gives the derivative of F at X equals A. So this gives the, or the derivative or rate of change of F at A. Okay, when I would input that, okay, and then here's a little bit more terminology. So finding this derivative. I'm kind of rotating through colors so that you can kind of see where the different thoughts are. Okay, and there's a name for this. So finding this derivative.

Derivative function F prime is called, so it has a name, if I'm trying to find the derivative, I'm going to say that I'm differentiating. Okay? So this is kind of new terminology also. I'm differentiating if I'm finding the derivative, that process is called differentiating, okay? So formally, what is this, so this process here, so formally. So formally, differentiating is finding, so this this new terminology. So differentiating, so differentiating is finding, and we'll do some examples of this. But this is actually kind of finding this limit, which is going to be the limit is going to look so familiar with the only difference being that I'm going to replace, so finding oops I, let's, I'm going to write that slightly differently. So it's going to be finding F prime of X, which is equal to, so now this looks almost exactly the same except that I replace A with X. So I'd write F of X plus H minus F of X divided by almost in the picture, F of X divided by H.

Okay? So let's, let's make that all the way in the picture just today. It's always, it's always easy for the person lecturing to think that it doesn't matter if there's something that's like slightly sloppily written. But if that's because we as a lecturer already know what it is. But if you're the student trying to understand it, you actually need to see the whole thing usually, right? Okay. So let's talk through, there's a lot of stuff here. It's just a lot of language, okay? We talked before about taking the derivative at a point, right? This is what we did when we take this limit here. But now we're just kind of defining a particular function, which is going to be the derivative. There's, it's no longer at a point. And one of the things that I think gets lost a lot when people teach calculus is the fact that this is a function. When you're computing the derivative at a point, you're inputting that point into the function. Okay? And then, so how do you get then that value at that point? You use this limit or whatever you know how to do to differentiate. So we're going to do this process of differentiating, not, like partly computing the limit, but sometimes not. And using various different properties. The thing to keep in mind is that when I'm differentiating, I'm getting a new function. If I want the derivative at a point, which gives the derivative or rate of change or slope at that point, I have to actually input that into the function. Okay, so maybe keep on kind of, I'll try to emphasize that a lot. But I also keep on reminding yourself of this because I think it's a very confusing aspect of what we're doing here. Okay, so I hope that makes some sense, and I'll see you in the next lecture.