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y naught, naught, partial derivative, naught y, equals, change, curve, function, point, derivative, line, tangent line, picture, x naught, slice, graph, partial, y coordinates, slope, approximates

SPEAKERS

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Welcome. In this lecture, I'm going to do a little bit of a picture of what's happening with the partial derivative of F with respect to X. And you can really just kind of replace everything in it in order to figure out the picture for the partial derivative of F with respect to Y. So I'm only going to do this one. And you have this kind of picture where you have, so I have some kind of function. So I have, this is going to be, let's just draw this. And this is like Z equals F of X, Y. So you know, F is a two variable function in X and Y. And so it's sitting at some height Z, so we have something below it. And this is as in like, right, if I'm wanting to look at my X and my Y coordinates, I have like, right, you can imagine that I have my X axis and my Y axis down here.

I know these look a little similar, but we're going to kind of do it, that actually we're going to change this, this is going to be blue. There's something about no matter how many times you write and rewrite notes, there's always something that as you're doing it, you're like, I really wish I had done this instead. And this is, so we're just going to do that, instead, we're just going to make that F of X, Y, it's going to be kind of blue here. Okay, so that's kind of the image of that so that it's distinct enough from that. I was a little worried it would be confusing when I looked at it now. And then we can have kind of a line here right, which is we can fix a particular, right, if I'm taking the partial derivative of F with respect to X, I want to fix a Y value, right? So maybe this is the line where, right, it intersects here at Y naught. So, this is the line Y equals Y naught. Okay, because I want to take the partial derivative at this point X naught Y naught, which is going to be sitting above here. So, you can see like kind of if I went up, you know you have some kind of point here, like if I went up from the point. I want it right there, let's just move it slightly off of here. So on here is a point, I have a point on here, which is like X naught Y naught. So this is X naught and then Y naught.

Okay? And then I have so, I have that point on there, and then I want to go up from that and get a point up here, right? So, the coordinates of this point are going to be, so, this is going to be the point. So I have X naught, and then I have the point Y naught, or sorry the coordinate Y naught. And then that has to go into my function. So, I get this Z coordinate is going to be F of X naught Y naught. Okay? And then this curve here so, you can imagine I came up and I kind of sliced through here, and maybe this is going to kind of look like this okay? So, this is going to be curved, this is what we get. So, fixing right, Y equals Y naught, right, i. e. kind of slicing along i.e. slicing along the Y equals Y naught plane, okay gives this curve.

Okay, so we get this kind of curve from it's like I slice, you know, I slice like this and I'm slicing through this surface kind of floating and I can slice like this and where, where I slice this surface gives me this kind of curve here. Okay, and the slope at that particular point is going to be, so and then maybe I'll just draw this like you know, so then if I actually had took this you know, if I if I took the tangent line to this curve kind of floating there, right, so I would get, so this is what I get this this curve, I get get from that curve is that curve. But then this here is the tangent line, and this has slope that's going to equal this derivative with respect to X of X naught Y naught. Okay, so let's go through this again, all of what I did, right? So we have our, you know, Z equals F of X, Y creates this kind of floating surface. And then if I'm interested in, and in there is this point, which is X naught Y naught F of X naught Y naught. So once I determine my first two coordinates, I know the last one. So I get this point here, but the point X naught Y naught is a point that lives down here, right. In like, you can think of this as where Z equals zero, this is like the X, Y plane here where Z equals zero. And then, so there's a point in here, I'm calling it X naught Y naught, really it's X naught Y naught zero. And then I can look at kind of this line Y equals Y naught here and kind of lift that up, or you can imagine slicing with the plane Y equals Y naught. And that gives me some kind of curve in this surface I got by Z equals f of X, Y, like the graph of that function. So, I get this curve, and then there's going to be a tangent line to this curve there. And it's slope is going to be that precisely, that precise partial derivative. Okay? And because of this kind of whole picture, and you know, what's going on, we know that, so DF. This is a little, not dark enough for my liking, so I'm just going to take this one. Okay, so we're going to see, so, this partial derivative of DF DX at X naught Y naught.

This approximates, right, what this is the change in, so this is, you can think of this as the, well maybe write, just do it like this. So, the change in F, no, actually, let's just do this like this. So, the change in F divided by the change in X at this particular point. So, at the point X naught Y naught, okay? So, if I'm looking at here, and I kind of go in the direction, so this is how does X change, right? How does the graph change as I change X, okay? And this is one of the things that I think confuses a lot of students is if I'm going along this line, I'm never changing Y, but I'm changing X, right? And that's why we have to fix Y, and then X is what actually changes as we move along this line. And the same thing is here is happening here. Like I'm moving along the graph of the function, but like my Y, this coordinate is never changing. It always stays at Y naught. It's X that's actually changing. Okay? And that's how we're looking at how the graph or the height, right, in this here changes as we change X and go in that direction. Okay? So, I hope that made some sense, and I will see you in the next lecture.