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SPEAKERS

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Welcome. In this lecture, I'm just going to go through what it means to be a local max or local min for a two variable function. So suppose that we have that, so suppose we have that A, B is not in the, on the domains boundary. Okay? So it's kind of inside, is not on the domains boundary. Okay? So that's kind of the supposition for both of these. So then we're going to say we have a local max at A, B. So what's the circumstance for that? So A, I want to these in green actually, so we're going to have a local max at this point A, B. And this is actually going to be, actually, why don't I just word that slightly differently? So we're going to say that, we're going to say, so F of X, Y is, so this is a local max, you know, and it's at A, B. And it's at A, B, right? So in what circumstance does this give us a local max? It's just another one of these tricky circumstances. We talked about this when we did one variable functions, where this is the input. And so you'd say, and this is what's actually the max, but you would say that it's at A, B. This is where the wording is supposed to mean. So if, so when does this happen? This happens if we have that F of A, B. So one I plug this point A, B into my function, I'm going to get out a value that's at least as big as what I get for any other function. This is the biggest value I could possibly get. Okay, so this is for all points X, Y, but we're only looking at nearby, okay, so for all points X, Y that are near my original point A, B.

So here's kind of the picture. So our domain, I'm going to do my whole domain in orange it's like it's, so we have down here this still kind of the height, okay? And we have the graph of our function, and I don't know what happens in other parts of it. I just know that, right, this is like the graph of my function, and I, what I do know is that I'm at this particular value here. So right, you know, not necessarily looking at what's happening in other places, but actually, you know, that this is going to give me, so F of, so A, B would be down here. It's some kind of point down here. And then if I put in F of A, B, right, this value, so this is like the, I'm going to steal somebody else's terminology for this, this is a hilltop high. Right, but it does kind of help that, you know, it's just a hilltop there might be multiple hills, right? Because in all reality, actually, this is likely also a local max and this is also local max. But if I look close enough by, right, so if I look close enough by over here, so I'm looking over here, then all of those values are less than it. It is the like peak value. Okay? And then for, we would say that F of X is a local min at A,B if we had that, and this is just the opposite inequality. So this is like when you're looking at points nearby, this is the lowest point. So that was the hilltop high, this is going to be the valley low. Okay? So we're going to get, if we have that F of A, B, now we're going to

have it actually be the low point. So it's going to be less than or equal to all of the points close by. So F of X, Y, right, for all points X, Y. And this is exactly the same thing. It's, we're just looking nearby because that's what when we have the local in front, that's what it means. So for all X, Y near A, B.

Okay, so now we're looking for kind of a valley low, so we have something. And then maybe it kind of goes. Having a little bit of maybe actually, in this one, the low point might actually be somewhere over here. It's a little tricky with these 3D pictures for it to be so clear. Oh, I know what I'll do instead. Okay, we'll make this much clearer. I think in that one, it's not as clear. So why don't we do it this way, we'll go like this. It's a, I think this for the graph of this function, it's much clearer that you know, when I'm looking here, this is actually a low point. Okay? So here, this would be like my F of A, B. Maybe I'll label this is my graph of Y equals F of X, Y, right? This again, this is my Y equals F of X, Y, this graph. And this is set point A, B. So it's like down here I have my domain where I'm defined, and then you know, maybe it kind of goes upwards. So that's like my Z axis. And my point A, B would actually be here.

Right, and then I'm looking up at the graph above that, and it's the lowest spot right? If I'm looking close by, then that really is the lowest point everywhere. If I'm sitting there, everything when I look around is above me. So this is a valley low. But I actually find that this kind of hilltop high and valley low can help kind of keep it straight a little bit. But we're just looking, and I particularly like the hilltop high in valley low thing. Because if you've ever been kind of hiking up in like mountains or hills, you know, there can be a whole bunch of hills, right? But, you know, the very highest point is going to be what we're going to talk about next time, which would be like the global max. But otherwise, you know, you've got these like local hilltop highs. And the same thing with the valleys, like there may be multiple valleys and some of them may dip lower, but when you're at the bottom of a valley, and you look around you, everything looks higher up than you. So that's kind of the idea of local. Okay, so, I hope that made some sense and I will see you in the next lecture.