

# PfaffModule4L01

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## SUMMARY KEYWORDS

slope, change, talk, delta, coordinate, x naught, axes, next few lectures, y value, delta y, function, draw, told, line, subtracting, rate, zoomed, point, wrt, negative

## SPEAKERS

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Welcome. In this lecture we're going to talk its somewhat of a warm up for when we talk about derivatives. And we're going to talk about the slope as the rate of change in the context of a line. Okay? So let's draw one for ourselves here. So this is, for lines, the slope is the rate of change. So there's just kind of explicitly write this all the way out. So for lines the slope, so the slope of the line is going to be a rate of change, okay? It's going to be is the rate of change.

And specifically, what is the rate of change of is because you always need to know what you're changing with respect to what. Okay, so this is going to be the rate of change of Y. And then we often like to write wrt, I'm going to write that a lot. So I'm just going to tell you now that this means with respect to, right, so again, we know the thing that we're changing, and then we need to know what we're changing it with respect to, okay? And we're changing it with respect to X, meaning that I am going to look at as X changes, how does Y change? Okay, that's what I mean when I say that Y is changing with respect to X, and that's the rate of change that we're looking at. So let's draw the picture. Going to return to the fact that I was making my axes I believe that this one was green. So just kind of double thicken that. So that's going to be green. And then I had a second axis, which was orange.

Right, and this was the X axis. So the this told me going left, or left and right was telling me how, what my X value was. And then my second factor you the height tells me what my Y value is. And now we're going to look at a particular function. So I want to look at the function. So we want it to be aligned, and I'm not going to be specific at this point. So let's just draw a line. But what I do want to kind of emphasize is that this is a line and its slope is going to be M. So we'll make that red so that every time it shows up, you know that I'm talking about it, and this is going to be  $MX + B$ . Okay, so what are kind of the different ways to interpret what's going on with that? Well say that we have two points on this line. So I'm going to look at two points here. And the first point I'm going to look at is going to be the point X naught Y naught, okay, so I have a point here, which is going to be X naught, Y naught, we say, right, X naught when we put a little zero there, just when that's our index. And then we can think for a moment and realize, okay, so that means that I'm looking at, right, this is my X

value, right from the first one, and the second one is my Y value, the second coordinate. Always good to be specific what you mean. So that's my Y value. And I'm going to look at a second point, which is going to be I'm going to call that one X one and Y one as I'm sure you could guess.

And then the first coordinate, right, so in this case, this is the first coordinate. told me, right, how far over and this coordinate again, is going to tell me how far over I go. Right with the possibility that it's negative, and I'm actually over there, but we tend to like to draw our pictures on this side for some reason. And then the second coordinate, so over there, the second coordinate told me the height, so we're going to look at that again. So we look at the second coordinate like that. That tells me where I am here. Okay, so what's the relation to all these things and this slope M that we're interested in? Okay, so let's look at that for a moment. So this here, if I look down here, right? This is my change right, this delta thing we use it to mean change is my change in X. Okay, and you can look at that as being here also, right? These are the same length. So this length here is my change in X. What is my change in X here? We think about this for a moment, and what we're doing is we're taking this X value and we're subtracting off this one, right? And that even works if they're negative, so don't get confused by that. So this is going to be X one minus X zero. And if I wanted to know, so now I want to know how high, so that's my change in Y. Remember, we're looking at how does Y change with respect to X? So I'm looking at how X changes, and then how that impacts how Y changes, right? So let's impact how Y changes here. So this is going to be, this is how much my Y changed, my X changed, how much did my Y change? Again, I take this is the same distance as over here, right? So first, we can do it over here, because maybe that's easier to see that I'm looking at the difference between those. So this is going to be, again, delta is kind of for change to like a capital Greek delta.

So delta Y is going to be Y one minus Y zero. Okay, so over here, this is Y one minus Y zero. So if my X changed by delta X, my Y changed by delta Y. But that actually, this should look a little bit familiar to you from back when we've learned about slopes before. So here, we actually have that if you look at this my slope, right, which is equal to M is actually equal to, well we know this from back when we first learned about lines and slopes and these things, this is actually equal to delta Y over delta X.

Right, and that's just equal to, right from looking over here, we actually can remember oh, wait, that's actually the same thing as Y one minus Y zero divided by X one minus X zero. Okay. So this equation that you've seen for the slope many times where you're just taking the change in Y, or the change in your elevation, so rise over run, so the change in Y over, right, which is the change in your X values here, so it's the X one minus X zero, that's just how we compute the change, is actually telling us how does Y change when we change X, which is going to be a notion that here, it's not going to matter how zoomed in we are, but we're going to be zooming in over the next few lectures. And you're going to actually see that we can do this with a function that's not aligned. But it's bringing it back to this exact same idea that I'm looking at rise over run. How does the Y value or the output value when we're talking about a function change when you change the input value, which is the X value? So I hope that made some sense, and I'll see you in the next lecture.