PfaffModule4L03

Sun, 1/30 1:49AM 10:18

SUMMARY KEYWORDS

slope, fastest, average velocity, distance, interval, meters, horizontal axis, seconds, cyclist, points, change, circumstance, largest, spaced, traveled, lines, divided, figure, moment, road

SPEAKERS

Catherine Pfaff

Welcome. So in this lecture, we're going to talk about a very normal circumstance, where you actually only have kind of the data at a certain number of points, and you want to get some kind of average rate of change over intervals to kind of understand what's going on just from that. So we've got the setup of some kind of cyclists riding down a straight road, so we have a cyclist riding on a straight road. So you're going to imagine they're kind of they don't go, they never go backwards, they're always going forwards, it's a straight road.

Okay, so they're always going like that. And then we're going to have some kind of chart. And our first coordinate, right, so our input is normal, this is going to be the time, okay, and we're going to have certain values for that. So we're going to have values after zero second, after 1 second after 2, after 3, after 4, and after 5. And then after each of those seconds, what we're interested in is the distance traveled after each of those seconds. So we'll go ahead and fill this in once I get these lines in here. Okay, so now we want the distance that has been traveled between second zero and whatever that second is. Okay? So I'm not looking at the distance, so when I say, you know, after zero seconds, I've traveled zero. After 1 second, I've traveled 1.4. When I say after 2 seconds, I've traveled 5.1, I mean, from time zero to 2 seconds, I've traveled 5.1. It's not the difference between these two. Okay. And then, after 3 seconds, I've traveled 10.7 meters. And then after 4 seconds, I've traveled 15.7 meters. And then after 5 seconds, I've traveled 25.8 meters. Okay, so that we could look at a particular question, which is so here's the question. Which is on which one second interval was she the fastest? So on which one second interval was our cyclist the fastest? We're going to assume she's a she. So was she the fastest?

Okay, so let's think about this for a moment. I going to kind of use red to kind of, you know, annotate on here. So let's think about what I mean by fastest. So what I'm really looking at here is the average velocity. Okay, so I'm looking for here, the average velocity. And then we have to think about for a moment. What could I possibly mean by this in this circumstance, okay? So this would be right, so if I'm looking for the average velocity, I'm looking for the change right in distance, right, in meters, divided by the change in time, in seconds, okay. So we can look at that over here. And before I want to do that, I'm going to kind of, it's almost going to give a hint that that look at our picture. And so our horizontal axis is going to be T. And this is going to be time, right? So this is time in seconds. And

then our vertical axis is going to be our distance in meters. So this is our distance in meters. And then we can kind of plot these points. So down the, it's, you know, it's nice on the horizontal axis, everything is very evenly distributed. So this is 0, 1, 2. And that's going to be good to know, when we're trying to figure out what's fastest is that the change, the bottom is always the same. Okay, the bottom is always one second, but the top is what actually changes. And so, right, our biggest number here is 25.8, right? It's always going further and further. And then we have right so we have 5, 10 and 15, relatively close to 5, 10 and 15, which would kind of, you know, we would divide this up into 5 pieces somehow or another, and then we'd kind of get 20, and then maybe 15 is around here. And then maybe the one with you know, 10.7.

I think I'm going to want that. I think I'm mildly unhappy with my spacing here, which is going to make it hard to figure out the fastest. Okay, so maybe I'll actually start on the bottom. So let's, let's do 5.1 here. And then 10.7, 15. So this is kind of equally spaced. So I'm actually going to put, this is actually going to be, let's just make this a little bit higher. And then let's make this up here. So this will be 25.8 up here. But we actually kind of want the scale to be more or less correct. So that we can actually figure out what's fastest. The only one we're missing now is 1.4. Okay, so what are these points on here, so we can go ahead and look at that. So we have 0, 0, we have 1, 1.4, we have 2, 5.1, we have 3, 10.7, we have 4, 15.7, we have 5, 25.8. Okay, and so what we can see, oops, this was the where I actually, it should be all the way up here. Okay, and so we can just kind of erase that. But then that's good, because that actually will help us keep straight in our mind what's going on that this is a very small slope, these ones are actually all relatively close to the same, right, it's almost like a line there. Because for each of those, you're kind of going up by more or less 5. But now we jump up to going up by 10. So that should be much steeper. Okay? So just kind of looking at it, I would say that here the slope is largest, right?

Which is going to kind of indicate to me that this is, that the average velocity is the largest. So it equals the largest average velocity. Just abbreviated average velocity there. Okay? So then when looking at this, I can kind of look and compute this over here. And if I wanted to do the slope, so here's my change in T, here is equal to 1. And if I wanted here, my change, so if I'm looking here, my change in distance is going to equal, so I'm going to take 25.8 minus 15.7, which should equal 10.1. Okay, so if I'm actually looking at what the change is on this interval, then I should actually get that my slope, right? As I go on this interval, 4 to 5 is going to equal, so I've got my change in distance over my change in time. So that's going to equal 10.1. Because I've got 10.1 divided by 1, so I get out 10.1. Okay, so on which one second interval? So this is the slope, and my answer is going to be on that interval, you can just kind of see it from there, you should look and see that this is close to 5, this is close to 5, this is close to well, you know, 1.4. And so my answer is going to be this interval here. So it's going to be the interval, 4, 5. Okay. So what did I do here? I realized that when I'm looking for the fastest average velocity, I'm looking for the largest slope, right? And so right, so this is after 1 second, I've got 1.4. After 2 seconds, I've gone 5.1. So that's, these points are actually coming from these lines here. So we're looking at distance as a function of time. So another way to look at this, and it's pretty easy to see here that the largest slope, right, because all of our changes in times are one, it's easy to see that we're really just looking for the largest change in distance, which occurs on that interval, right? If I managed to go around 10 meters in a particular, like in an hour, that would be much faster than if I went 5 meters in an hour, right? Okay, so we're looking for the steepest slope, and we managed to get that there. And that should actually come from the change in distance, which would be the change over here, for the change in time of those input times. And so we're, our answer is going to be the interval 4, 5. So I hope that made some sense and I'll see you in the next lecture