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SPEAKERS

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Welcome. In this lecture we're going to look at a specific example of how you might approximate going from the velocity to the distance, or you know, a change in distance or, you know, any rate of change function to a change in value. And so, so distance traveled is kind of a change in value for position. And we're going to start with this circumstance of this is very typical, that one actually just has a certain amount of data and you want to kind of approximate what's going on. So we have over here we have our time values. And then after point 5 seconds, I'm at a velocity. So at point 5 seconds, I'm at a velocity of 5 feet per second, at 1 second I'm at a velocity of 7 feet per second, at 1.5 seconds I'm at a velocity of 8 feet per second, at 2 seconds I'm at a velocity of 8 feet per second, at 2.5 seconds I'm at a velocity of 9 feet per second, and then at 3 seconds I'm at a velocity of 10 feet per second. Okay, so that's kind of our setup. And then our task is going to be, and maybe I'll write the task down here. So the task is going to be the distance traveled, or approximate.

Approximate the distance traveled in three seconds, so distance travled in 3 seconds. Okay, so let's start out by drawing to see kind of what we're dealing with. Maybe put this in a situation we've been dealing with a lot. So we'll start out with, so we have T. And then we have on this axis, so we're going to have, we have our, our top, I'm going to look at my velocities here, because I'm actually going to be graphing the velocity function. So I need to worry about 10. Somewhere in here I have 5, which is like half of it. And then I'm going to need 7, 8, and 9, so I go like, skip, and then go 7, 8, 9. Okay, so these are values. And then the times that I'm interested in, are going to be times. So I have my times coming from over here, I'm going all the way up to 3. I have 1, I have 2. And then I have point 5, and I have 1.5, and then I have 2.5. Right? And then I can I know these specific points because I'm, I'm plotting the velocity function compared to time. So at point 5, I should be around 5, at 1.0 seconds, I should be at around 7. At 1.5 seconds, I should be around 8. And then at 2.0 I'm still should be at around 8, at 2.5 I should be around 9.

And then at 3, I should be around 10. And then I don't actually know what's going to happen elsewhere during this time. So maybe I go up and then I go down. I just know that definitely I'm passing through each of these. Okay, I don't really know what happens at the other times. And then what am I kind of what am I going to want to be doing? Well, I don't know at zero, so I know at point 5, so what I'm going to be actually looking at is, if I want to figure out the distance traveled, then at point 5 seconds, I have this as my velocity. At one second I have this as my velocity. At 1.5 seconds I have this as my velocity. At 2, and then at 2.5, and at 3, right, so we're back to you know, approximating this, this area under here, right because this, this area under here is going to give me the distance traveled. I forgot to write here that this is Y equals G of T.

Okay, so these are kind of the same, the same picture there. And I know that I'm looking at these areas and using them to approximate the area under the curve, which would actually give me the exact distance traveled. But I don't have enough data for that. So I'm just going to approximate with these rectangles. Something else I know on here, so I do have my delta T's. So here are my delta T's. So these are my delta T's, my changing times, which I can compute. Here, each of them is the same, that isn't necessarily true, but in this circumstance are the same. And I can do this over here, the exact same thing. So my change in time going for between each of these. So if I want to go here, so my change in time is going to equal 1.0 minus point 5, which is going to equal point 5, right? And then I can keep going like that. So this one, so each of these is actually going to equal point 5. Delta T equals point 5, right. Each of them I would get by taking 2 minus 1.5 is point 5, 1.5 minus one is point 5. So each of these, 2.5 minus 2 is point 5. Each of these is the same in this particular circumstance. 3 minus 2.5, that's also point 5. So right, this is my change in time between, right that's showing up over here between the values of velocity that I have, the times in which I have the values for the velocity. So if I wanted to actually to compute this approximation, right, so this area of these rectangles, so this area.

So this area is going to, approximates the distance traveled in 3 seconds. So I want to go ahead and try to add these up. So I get, right I'm going to take the area of each of these. So I'm going to get this delta T times V of point 5. Right, that's the area of the first rectangle. And then I add to that the area of the next rectangles, so plus delta T times, now I'm going to take the velocity at 1 to get the area of this rectangle, so the velocity 1. And keep going I can take delta T times the velocity at 1.5. Plus, so now I'm at, I've done the three, first three rectangles, so I have three more to do. So I have delta T times the velocity at 2. I still have this rectangle to do, so I have, so plus, and then I have delta T times the velocity at 2.5 to get this rectangle.

And I'm almost done because I just need the area this rectangle circle. So I've got plus delta T times the velocity at 3. Okay? So this is just adding up the areas of these rectangles. For each of them, I have my width delta T, which is point 5, and then my height is going to come from the velocity on the right endpoint, okay, and I have those values here so we can keep going. And I also know that my delta T equals point five. In fact, I'm just going to pull that out to the front because it lives in front of each of these, I can just kind of pull that out to the front. So I get point 5 times, and now I just need so the velocity, you can just look over here. So the velocity at point 5 is there. So that's 5. My velocity at 1 is 7, my velocity at 1.5 is 8. My velocity at 2 is 8.

My velocity at 2.5 is 9, and my velocity at 3 is going to be 10. And then we can just go ahead and compute this, and this is going to equal going back to, right, this is equal to 47 divided by 2 feet. Okay, this is a computation that you can do, you can add up all of these, and then the the dividing by 2 comes from that the same thing, you know, point five is the same thing as one half. Okay, so what did we do here? We looked at, you know, some circumstance where, you know, and I just scribbled in a graph in between, just to emphasize there is a graph in between, and that this is exactly the same problem. But if we want to go from a rate of change to a, you know, change in value for some kind of function. Like here where I want to know the distance traveled, and my rate of change is my velocity. And I only have it at some number of points, and I can exactly use this Riemann Sum measure of approximation to figure out, you know, approximating just by adding up the rectangles, which would be you know, if that was a constant velocity, how far would have I traveled, we do that for each of the time intervals, we add those up and we get an approximation for the distance traveled. Okay, and the 3 was from this interval from zero to 3. Okay. So, I hope that made some sense, and I will see you in the next lecture.