Let’s have a look at a second more complex example. In this second, more complex example, we have an object of mass five kilograms being acted upon by some empirical force law, F=-kx, where x is the position of the object, and k is a constant measured from the data. In this case, k is equal to 50 N/m. The object begins at 0.1 meters with a speed of 2 m/s. We want to solve for the motion of the object iteratively, for 0.01 seconds using a step of 0.01 seconds, so our table will only have two rows, t=0 and t=0.01 with the usual columns, time, position, velocity, acceleration, and force. Let’s begin with t=0. What do we know? Well, we know that the object is initially at 0.1 meters, so we can substitute in that value, and we know its initial speed is 2 m/s, so we can substitute in that value. Now we move on to the force in this problem. The force is not a simple number; it’s a function F=-kx. We know what K is, it’s 50. It’s given to us in the problem. But now we got to think about x: which x should we use? Well, the idea of object egoism tells us “me me me” and right now, so I need to think about what’s going on with the object right now. Right now, the object is at 0.1 meters, and so we substitute 0.1 meters in for x. Solving the problem, we get a force of -5 N. Now we can move on to solving for the acceleration using Newton’s second law, F=ma. A -5 N force divided by 5 kilograms gives us an acceleration of -1 m/s^2. So, our force and our acceleration are in opposite directions. From our velocity, our velocity is positive, acceleration is negative. Thus, from our Unit 1 knowledge, we can predict that the object should probably slow down. When we go from 0.00 to 0.01. Now, in the last problem, we started with force, so let’s try that again. Our force law is still -kx. We still know that k is equal to 50, but we don’t know what x is. We need to use “me me me” and right now. We don’t know the position of the object right now. Sure, we knew where it was, but that’s not what matters in physics, what matters is what’s going on to the object right now. Objects are stupid for the most part; they don’t remember, so we need to think what’s going on right now, and we don’t know, so consequently we should probably solve for position first, using the definition of velocity expanded into this usual form. We start looking at plugging in the numbers. The initial position is 0.1 m, the initial velocity is 2 m/s, and the Δt from 0 to 0.01 is 0.01, which comes out to 0.12 meters. Now that we have a position, we can use this position in our force law to solve for the force, and get a force of -6 N. Now we can continue in our more usual way of using F=ma to solve for the acceleration, -6 newtons divided by 5 kilograms will give us an acceleration of -1.2 m/s^2. Finally, we have to deal with the velocity, and we use the definition of acceleration, expanded into this typical algebraic form, and we look at substituting our numbers. The initial velocity over this interval is 2 so we substitute 2 m/s. Our initial acceleration is - 1 m/s^2, and our Δt is 0.01 s. Turning the crank on these numbers, we get a velocity of 1.99 m/s^2, so our object has slowed down in agreement with our expectations. Our object went from 2 m/s to 1.99 m/s, which is what we expect, given that at t=0, our velocity and our acceleration are in opposite directions. So, let’s conclude. Many of the procedures that we’ve discussed in this video are like the iterative calculations we have already discussed in unit one. Remember to think about one instant at a time, and to use one instant to predict the next. The new part introduced in this video is that the acceleration at a given instant is determined by the force at that same instant so we use the force at t=0.003 to solve for the acceleration at 0.003. This is in line with our object egoism of “me me me” and right now. Similarly, if the force depends upon other variables such as position or velocity then I need to use the values for the same instant for which I want to calculate the force. So, if I want to calculate the force at 0.004 seconds and it depends upon position, then I need to use the position at 0.004 s. Again, “me me me” and right now. This concludes this video.