This week, we will examine some more advanced topics in the application of Newton's laws of motion.

First, we will look at more examples of constrained motion, where the motion is forced to obey some particular condition in addition to Newton's laws of motion.

These conditions usually specify some particular relationship between coordinates of objects and the system we are studying.

Specifically, we will re-examine the case of objects suspended with pulleys and ropes, but with more complex systems than we have discussed previously.

The fact that the ropes have fixed length will provide a constraint condition relating the coordinates of our various masses.

Second, we will examine the case of forces acting on a continuous, extended mass distribution as opposed to acting on discrete point masses.

This will allow us to introduce a powerful differential analysis technique from calculus where we model continuous mass distributions as made up of lots of small, discrete mass elements and then examine the limiting case of infinitesimally small elements to obtain the continuous behavior.

This is a technique that you will see applied over and over again in physics and engineering.

And in fact, we will return to it again later in this course.

Our specific example will be to study how tension varies in a long, massive rope.

This is in contrast to the light, effectively massless ropes that we discussed previously.

Finally, we will discuss velocity-dependent forces-- that is, forces whose strength depends on the velocity or some function of the velocity of the mass being acted on.

The most common example of this is resistive forces or drag forces, which are caused by motion of a solid object through a fluid, like air or water.

That is the example we will discuss this week.

Another example you may be aware of is the magnetic force that acts on a charged particle, which depends upon the velocity of the charged particle.

In all three of these cases, we will simply be applying Newton's three laws of motion, but the situations will require a more sophisticated treatment to what has come before.