When we analyzed a single particle motion-- say, we have an object, which is moving with momentum p-- then we have two principles.

Our Newton's second law told us that the force on the object causes the momentum to change.

And now, what we'd like to do is consider another principle.

Suppose we're looking at some point about s.

We'd like to show that the torque about s is equal to the change in angular momentum of the particle about s.

So let's now investigate that.

Well, recall that angular momentum is defined to be about a point, a vector s, and will indicate m to show that this is the vector from s to where the object is located cross the momentum of the object.

And what we want to now calculate is the time derivative of that quantity.

Well, when you take the time derivative of a vector product, it's the product rule.

And so there's two terms here.

It's drs/mdt cross p plus rsm cross dp/dt.

Now, no matter what the point s is, the derivative of the vector that's measuring where s to the mass is is always the velocity of the object.

So that's the velocity.

And momentum is just mass times the velocity.

And you can see that that quantity is 0 because a vector direct product with its cross product with itself is 0.

And this second term-- notice that we have dp/dt in here.

And it's always crucial to understanding these calculations where the second law comes in.

This is just rsm cross f.

And recall that when we talk about the torque on an object about the point s by the action of, say, some force.

And so suppose we had a force acting on this object.

And that's going to cause the object to change its direction by some amount delta p.

Then the torque, by definition, is rsm cross the force.

And we see that that is exactly equal to the change in angular momentum.

And so for a single particle, the torque about a point s causes the angular momentum about that point to change.

And this result will generalize for a collection of particles in a calculation that's very simple.