We'd like to consider torques on a body.

Let's draw an arbitrary body, and let's consider a point s, that we're about to calculate the torque.

Now, we know that forces on the body can be both internal and external.

And we'd like to show that all internal torques will cancel in pairs.

The way we'll do that is, suppose we pick an object.

We'll label it with mass mi, and another object, we'll label that with mass mj.

These are small mass elements in the body.

And we'd like to know something about the internal forces.

Now, let's make the assumption-- and this is the key property-- that the force due to this interaction between j and the i-th particle pointing that way-- and here's the Newton's third law pair-- that these forces lie-- are directed along the line connecting the two bodies.

With this assumption, we'll now show that the torque due to these two internal forces, [INAUDIBLE] Newton's third law pairs will cancel.

So let's calculate that out.

So we draw our vector from rsi, and our other vector rsj.

And now we're in position to add these two torques.

So we have the torque on s due to this pair is equal to the sum of rsi cross fji plus rs-- that's an r-- make sure we get that right.

We have rsj cross fij.

Now, the third law pair says fji is equal to minus fiji.

And so, if we substitute-- let's put the minus sign over here-- we get rsi minus rsj cross fji.

Now, let's look at this vector in particular.

We can draw it again over here, just to see it.

Here s.

Here is rsi.

Here is the vector rs, that's rsj.

And we want to now consider the vector rsi minus rsj.

Notice that this vector is directed along the lines connecting the i-th and the j-th particle.

And we've made an assumption that fji is also along that line.

So these two vectors, in this particular case, are either parallel or anti-parallel.

And hence, the torque due to the sum of these internal forces cancel in pairs.

And this means we only need to address the torque due to external forces that are acting on individual elements in a body.