We would now like to use Newton's second law to relate impulse to change in momentum.

So again, let's look at our set up.

We have an object m, a velocity V, and, let's say, here the picture as t initial.

And we have some initial velocity.

And then a little bit later in time, we have time t final.

The moment the velocity has changed.

And that's because throughout this time interval, we're applying an impulse.

We can call this the i hat direction.

Now recall that our definition of impulse, it's a vector quantity.

It's equal to the integral of the force.

Now when I write force of t, I mean force as a function of time.

And that's our dummy variable t prime.

It's not force times time, but force is a function of time.

And we're integrating from the initial to the final time period.

Now here's where we use the second-- the version of Newton's second law, which is that force causes the momentum of an object to change.

So we can write this integral t prime t initial, t prime equals t final of dp dt.

I'll just make a note that we've now applied Newton's second law, and because we're using our dummy variable dt prime And you can see that the two dt primes cancel.

And this just becomes the integral from t initial t prime to t final of dp.

And this is a pure differential.

And so we end up with impulse is the momentum at t final minus the momentum at t initial.

Now recall, this is a vector integral.

But a vector integral is just three separate intervals for each component.

So each component of impulse satisfies this equation.

For instance, the x component of impulse is how the x component of momentum is changing in time.

Now generally, when we write a final momentum in our final state minus the momentum during initial state, we can call this the change in momentum.

So down here, we would have change in the x direction.

And so in conclusion, we now have an integral way of casting Newton's second law.

We have that impulse causes momentum to change.

And so we can see that the si units of impulse are the same as the si units of momentum, which we saw before was kilogram meter inverse seconds.