So now, we wrote down the momentum of the system of our rocket at time, t, and the movement of the system of the rocket at time t plus delta t.

Let's make some simplifications in our notation just to make our calculations a little more easy to read.

So the first thing we want to do is we want to say that the mass of the rocket at time, t-- this is the mass of the rocket plus the mass of the fuel in the rocket at time, t.

We're just going to denote that by mr.

And keep in mind that, when you write the mass at time t plus delta t, we'll write that as the mass at time t plus delta mr. This is precisely how you define a differential.

Even if this quantity is negative, you always write the difference.

m of r of t plus delta t minus m of rt equal to delta mr. That's how we write a differential delta mass of the rocket.

So the mass of the rocket at time, t, looks simpler-- m of r plus delta mr.

So those are two ways of simplifying our expressions for the terms that are appearing here and there.

Now, the next thing was, recall from our mass conservation, that we had the condition that delta m fuel was equal to minus delta m rocket.

So now, we'll take those two simplifications, and now we'll write down our system momentum at time, t.

That's very simple.

mr v of r at time t, and we'll now write the momentum at time t plus delta t.

Well, we have the first piece, which is mr plus delta mr times the velocity of the rocket at time t plus delta t.

Now, be careful here because we're going to use our conservation of mass condition to replace delta m fuel with minus delta m rocket, and we'll use our expression for the velocity of fuel in the ground frame of the rocket.

So we have minus delta m rocket times the velocity u plus v of r of t plus delta t.

And this simplification, we'll write equations 1 and equation 2, will enable us to apply the momentum principle in a very transparent way.

And that's what we'll do next.