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SPEAKERS

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Hello, my name is Robert J McKeown, and welcome to our module on functions. Functions are really useful in the social sciences if we want an equation where one variable is explained in another. So for example, in political science, you might have a theory or be interested in a theory where older people tend to vote conservatively. So the older a area the people in an area are, the more likely they are to vote conservative. And so you can see that age is influencing voting habits. And that's really what a function is. So we've got one variable affecting another, we're going to go through various definitions of functions until we get to the last one, which is quite mathematical and robust. We're going to do a lot of examples together, we're going to look at graphs of functions, we're going to look at graphs of things that are not functions, so you could see what a function is, and you're going to see what a function is not. Now we're ready to get started, I want you to have your mind on, I want you to be ready to learn. Have a pen and paper with you so you can make notes as you go when you see interesting things. You can have an E pen and tablet if you wish. And I really encourage you to work through the problems with me. So that will help you remember them later.

The first question we're going to answer is, what is a function? I believe we have two answers to this question. Both of them are correct. One is more detailed than the other. Our first definition is on the slide beside me, you can see that it says a function is an expression rule or law, maybe you want to focus on a rule, that's a very, that's the easiest of them, that defines a relationship between one variable and another variable. So let's look at a really simple example of a function, think of a vending machine. If you add two Canadian or US dollars to a vending machine, you will receive one soft drink. And you can think of the $2 as an input, it's information coming into the vending machine, the vending machine is going to be our function. So that is the function. Sometimes we can think of a function as a machine, here, we got a vending machine. And if you put in this input, the function will give you one soft drink. So the one soft drink is going to be our now we're going to these are not very formal terms other than the function part. So we're going to introduce some new definitions and vocabulary a little bit later. Here are two more examples of functions, they're not quite as simple as the first one, you can think of the distance a car will travel. So the distance you're going to go, that's your output, the car or the fuel efficiency of the car, that's your function. That's what's going to get you there. And your input here is going to be the gasoline and your fuel in your fuel fuel tank. That's gonna be your input.

Our last function is one from economics that became very popular in the 1980s. And it says that government revenue is a function of the tax rate on income. So let me draw a graph of this, this this function. So I've got my I'm going to have the tax rate here. Let's put government revenue on the Y axis, and let's put the tax rate on income on the X axis. Now, if the tax rate is zero, so we got 0% tax rate government revenue is going to be zero. I don't think that's a very controversial statement. As the tax rate increases, so as we move to the right along our graph or diagram government revenue is going to go up. And according to an economist by the name of Laffer at some point along the way, and maybe I'll draw, or I'll write in 100% tax rate here, somewhere along the way, revenues are going to fall. If the tax rate is 100%, people are going to choose to work. Not at all, they're not going to work if someone else takes all the benefit of their work, and they get nothing in return. So government wants to keep its tax rate between zero and 100%. And if you look at this graph here, the way that I've drawn it, we can kind of see that up here, we might even call this point here T star where government revenue is at its highest point. And this is something called the Laffer curve. So that's a graphical illustration of a function, if you tell this function, the tax rate, say here, the tax rate is 40%, then this function would be able to tell you the government revenue in dollars over there. This is an example of a function.

Now let's look at a math function. So I've taken an example from the sciences or physical geography, you're probably aware that there's a Celsius scale. Celsius as a way of measuring temperature. And you're probably aware that there's also a Fahrenheit scale, a way of measuring temperature. And there is a function right here, we have a function that that tells us how to convert from Fahrenheit, or excuse me, from Celsius to Fahrenheit. So if we want to go from Celsius, the Celsius is going to be our input. And the function, this mathematical equation, this machine is going to give us an output which has Fahrenheit, it's going to tell us what the Fahrenheit is given the Celsius. If we look down here, at this part of the slide, we can see that we've got a set. And it's titled Celsius, and we have three numbers in that set. So we've got Celsius minus 10 degrees, that's pretty chilly. You know, I live in Toronto, Ontario, minus 10 in the winter is a pretty cool day. Not the coldest, but it's pretty cold. 20 degrees Celsius, that's my kind of day, really comfortable, great for athletics. 30 degrees, I don't know about where how you feel, but for me, 30 degrees is pretty hot. Maybe a little too hot for what I like these days.

We can use our function to convert this Celsius scale into Fahrenheit. So why don't we do that? Right. Now, let me just remind you that this is the function, this whole thing here is the function. This whole thing right there. And we've got minus 10. We're going to multiply it by 1.8. And we're going to add 32. That is going to give us 14 degrees Fahrenheit. So my idea I'm used to Celsius, we use Celsius in Canada, I've gotten negative 10 degrees in my mind, I kind of know what that temperature is the equivalent to my neighbors in the United States is going to be 14 degrees Fahrenheit. If it's 20 degrees Celsius that's the equivalent of 68 degrees in the United States, so if you're in the States, he say 68 degrees Fahrenheit. It's a similar thing to say and in Canada 20 degrees Celsius, that's what people are going to think of. And the last one is 30 degrees Celsius my idea of a hot day. When I do the calculation, I find that it's 86 degrees Fahrenheit. So 86 degrees Fahrenheit is quite hot as far as I'm concerned. And anything higher than that is a little too much for me.