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SPEAKERS

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Hello, and welcome back to another video on applied derivatives, we're looking at taking the first implicit derivative in this example, we want to find Y' . But there's a few things to notice with this problem. One, we've got a general form function. In fact, we have a general form function within another general form function. Let's see how we can solve this problem and come up with the right answer, which follows all the rules of derivatives that you've learned previously. There's more than one way to get started on this problem. But why don't we begin by taking the implicit derivative of expression number one, and so we're going to take $D_{DX} GH$ of X minus YX minus Y squared, which is equal to $D_{DX} 0$, which will just be zero. Taking the derivative of this thing, we're going to have G' prime H of X , I'm using the chain rule here, multiplied by H' prime X minus oh, I have to use the product rule for this part. So we're gonna have just a Y minus Y' X minus $2Y$, Y' is equal to zero. Now let's solve for Y' . So we have a Y' here and a Y' here. So I could rewrite this expression G' prime of X , H' prime X minus Y is equal to Y' X plus $2Y$ Y' . If I keep my Y' prime's on the right hand side of Y' X plus $2Y$, the right hand side doesn't change, we just have G' prime, H of X , H' prime X minus Y . And then if I divide both sides of the expression by what's in the brackets here, we get G' prime H of X times H' prime X minus Y divided by X plus $2Y$.

And so there we have it, there is our Y' . Now, notice that we could, we haven't used equation number two, because actually, H of X is not just a general function, it has actually been defined for us. So let's write this down. G is a general form function while H is specified. Now I could say, we know that H of X is equal to $2X$ squared plus four. And therefore, H' prime of X is going to be equal to what? It's going to be equal to $4X$. So we could rewrite this expression down here as Y' is equal to G' prime $2X$ squared plus four times H' prime of X , which is $4X$ minus Y over X plus $2Y$. So that's one way we could have gone about solving for the first implicit derivative, recognizing that G is a general form function, but that H of X , we actually have a specification for and so we can remove the general placeholder H of X and H' prime of X with its specified equality.

Looking at our next example, it follows from the previous one. We have a general form function G , which is a function of this specified expression $2X$ plus Y . Here we have G as a function, but it's in general form. While $2x$ plus Y is specified. You can think of that as an embedded expression inside the

general function g . Now, let's go ahead, we're going to find y prime, we're going to take the implicit derivative of this expression. And when we do that, we're going to, well, first, before we do that, let me write out the operation that we're going to do.

Now taking the implicit derivative of G of $2x + y$, we get G'_{2x+y} , we want to use the chain rule. So now we want to take the derivative of what's on the inside the derivative, the inside is going to be $2 + y'$. Moving on to the next term, we've got $-2x + 2y$, y' is equal to zero. Our next step we want to solve for y' , so we have a y' here and here. I'm going to expand this first term. And so we have G'_{2x+y} , multiplied by 2 , plus G'_{2x+y} , multiplied by y' plus $2y$, y' is equal to $2x$, we'll move the $2x$ term over to the right hand side. And similarly, we're going to move this term over to the right hand side as well, so that we've isolated our y' 's on one side of the expression. So I can write $y' G'_{2x+y} + 2y$ is equal to $2x - 2G'_{2x+y}$. Dividing both sides of the expression by what's in the bracket here, we're going to have y' is equal to $(2x - 2G'_{2x+y}) / (G'_{2x+y} + 2y)$.

And we can factor out 2 in the numerator. So I have $(2x - G'_{2x+y}) / (G'_{2x+y} + 2y)$. So here are some examples of how to take derivatives as expressions that have embedded functions in a general form. We saw how you could take the derivative if one function is within another so you're using the chain rule. And you saw that you know, why is changing when x changes? Why are these useful? Why are these gonna be helpful for you? Well, it's gonna help you understand textbooks. It's gonna help you understand lectures in the future, when you want to understand what's going on in a certain topic, whether it's political science, whether it's business, finance, marketing, or economics.