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Thu, 11/25 3:19PM 10:01

SUMMARY KEYWORDS

function, equal, squared, unknown variable, solve, profit maximization, problem, laffer curve, 2x, rewrite, challenging, mathematical, switched, kernel, expression, case, differs, combine, answer, calculator

SPEAKERS

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Now that you've seen how we can combine functions together using the Laffer curve, let's do some more more mathematical based examples to see different things that we can do, or different ways that we combine functions together. Once we've gone through these mathematical examples together, we'll look at another application from business and economics, where we're looking at profit maximization using a revenue function and a cost function. But before we get to that, take a look at the problem in front of you. We're being asked to find F of five, plus G of six. So we can break this into parts. And we've got our F of X function here, I could rewrite this as F of five is equal to two times not X. Wherever there's an X I'm going to put in a five minus four, and that's going to be equal to 10 minus four, which gives us six. So that takes care of F of X, let's look at G of X, same thing, G of X is going to be G of six. Wherever there's an X, I put a six. In this case, we're going to have six squared, G of six is equal to 36. So now, we know that five, plus F of six is going to be equal to six, plus 36, which equals 42.

Here's our next question. And it's a little more challenging. Here we have G of F of five. So we have a function embedded in another function, we can solve this in actually a number of different ways. We know that F of five is equal to two times five minus four, which equals six. So we could say that G of F of five is equal to G of six. And we know that G of six is equal to plug in six, wherever there's an X and this expression here, six squared, which equals 36. So G of F of five is just equal to 36. Now we could have done this the hard way, we could have said, well, if I want to find G of F of five first, find G of F of X. And we're looking for that, we're going to take our G function here. And we're going to take our F function here, and we're actually going to plug F of X into G of X. And so we get G of X is just X squared. So we're gonna have F of X squared, F of X is equal to 2X minus four. 2X minus four like that. And you can see, if we let X be equal to five, we're going to have two times five minus four squared, and that's going to give us well six squared, which gives us 36. And so, either way, we get the same answer, but all else being equal, you probably prefer to do it this way. Cuz that's more simple and you could even use your calculator to help you. While finding this expression here, you have to be a little more careful on it, it doesn't look as nice, it's not as easy to work with.

Now, how about F of G and five, notice that the functions have switched position. And in general, it

will be the case that F of G of X is not equal to G of F of X. It matters, it matters which function is the exterior function, and which is the interior function, or sometimes the interior function is called the kernel. Now, this is in general, that's not to say that it's always the case that the two will not be equal to each other. So we've switched the positions here. So we've got F of G of five. Well, G of five is equal to five square, which gives us 25. And F of 25 is going to be equal to two times 25 minus four, that's going to be equal to 50 minus four, which is equal to 46. And notice that our answer differs from the previous problem that we did together. Now, let me rearrange this a little bit. And let's solve this problem again. But let's do it the more challenging way. And the more challenging way, now, the more challenging way tells us to find F of G of X. And that's going to be equal to well, F of X is 2X minus four, so I'm going to have two times something minus four, wherever there's an X, there's just one right there, I'm going to plug in G of X, which is equal to X squared. So I'm going to put an X squared in there. And I could just rewrite this as 2X squared minus four. And our X value is supposed to be five, right, that's the five we've got right here. And so if I want to find F of G of five, or now we can sub in X is equal to five, that's from over here. And we get two times five squared minus four, and that's going to give us 50 minus four, which is equal to 46.

So we've got F of two times G of X. How can we go about solving this? Well you can see that we don't have an X, so the X is a unknown variable. And we have to solve this kind of the hard way that we were doing it before, the more complicated way. So we want to take our F of X function here, and then we're going to plug G of X into it. Now we want to find F of two G of X. And so we're going to have our F function. And wherever there's an X in the F function, we're going to plug two G of X. Two G of X is equal to 2X squared. And wherever we see an X in the F of X function, we're going to plug in this 2X squared. So we get two times 2X squared minus four, and that's going to give us 4X squared plus 4.

Now X is an unknown variable, so we can't solve for a numeric solution here. We're just going to leave X as an unknown variable or as a placeholder in our solution.