NPTEL
NPTEL ONLINE COURSE

Discrete Mathematics
Functions

Example of Composition of functions - Part 2

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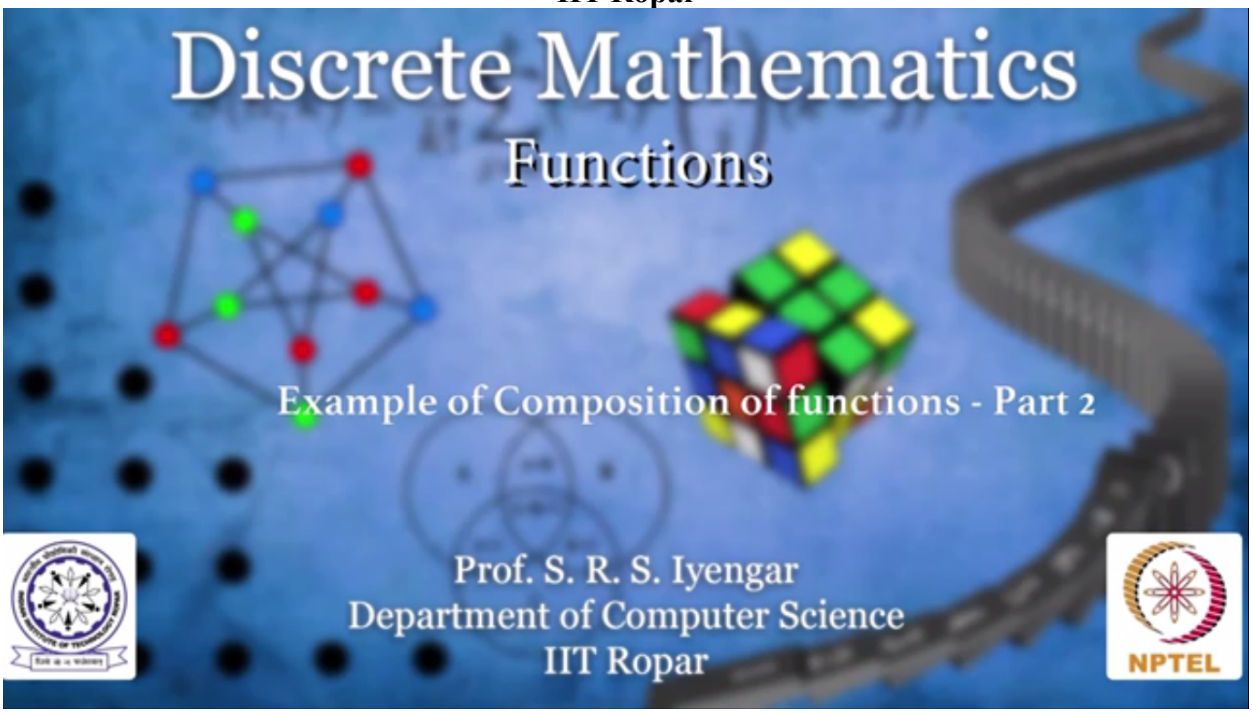
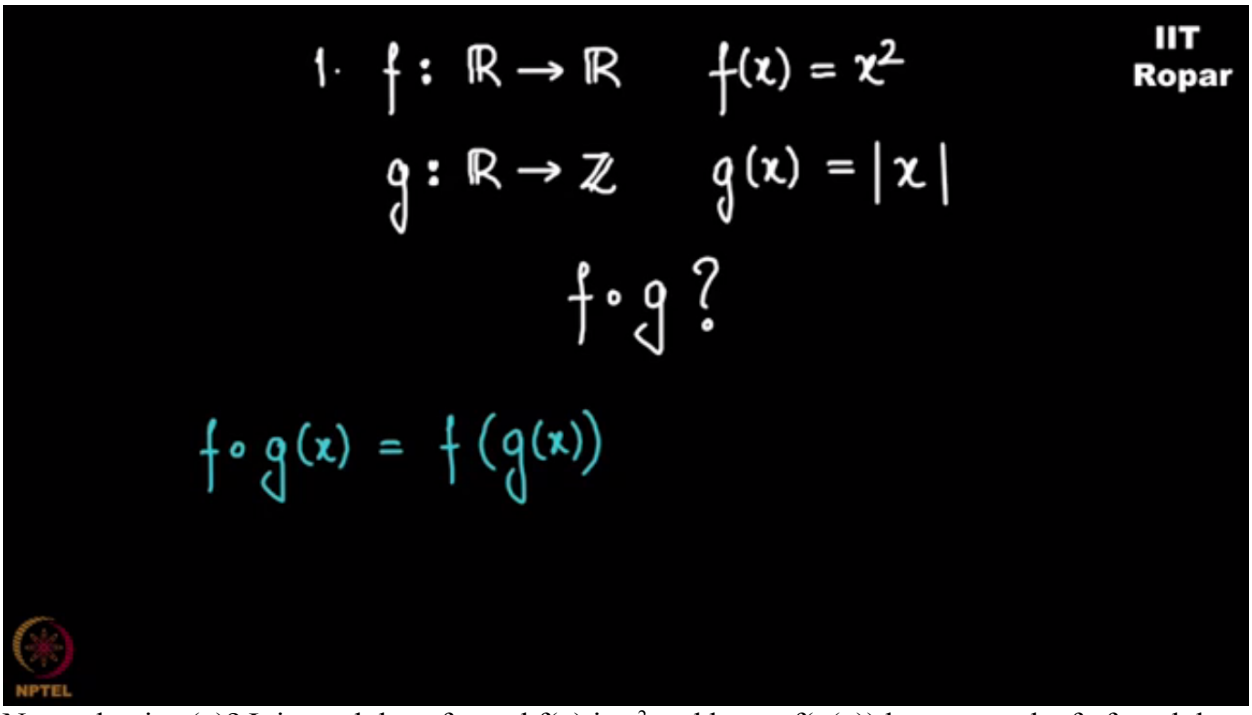
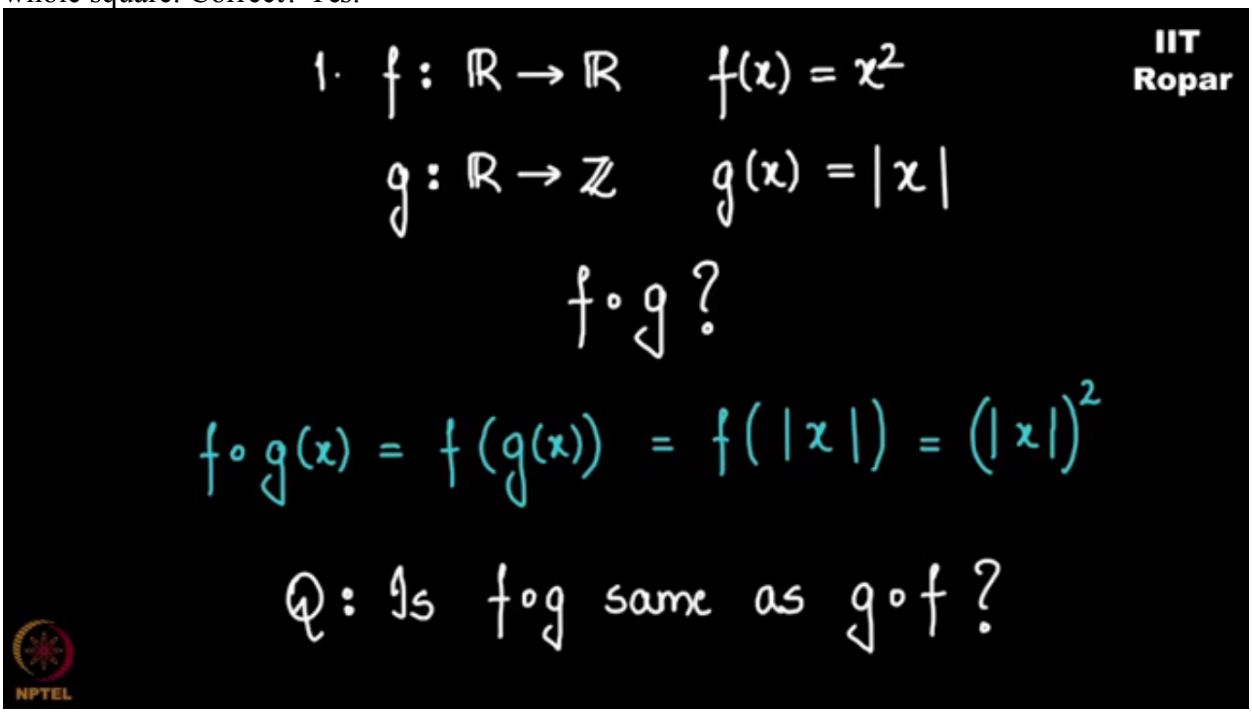


Let us quickly train our mind with more problems on composition of functions. Consider this function f from the set of all real numbers to real numbers defined as $f(x) = x^2$ and g from R to Z, real numbers to integers defined as g(x) = modulus of x.

Now what is f composition g? f composition g(x) is f(g(x)). This is how composition is defined as.

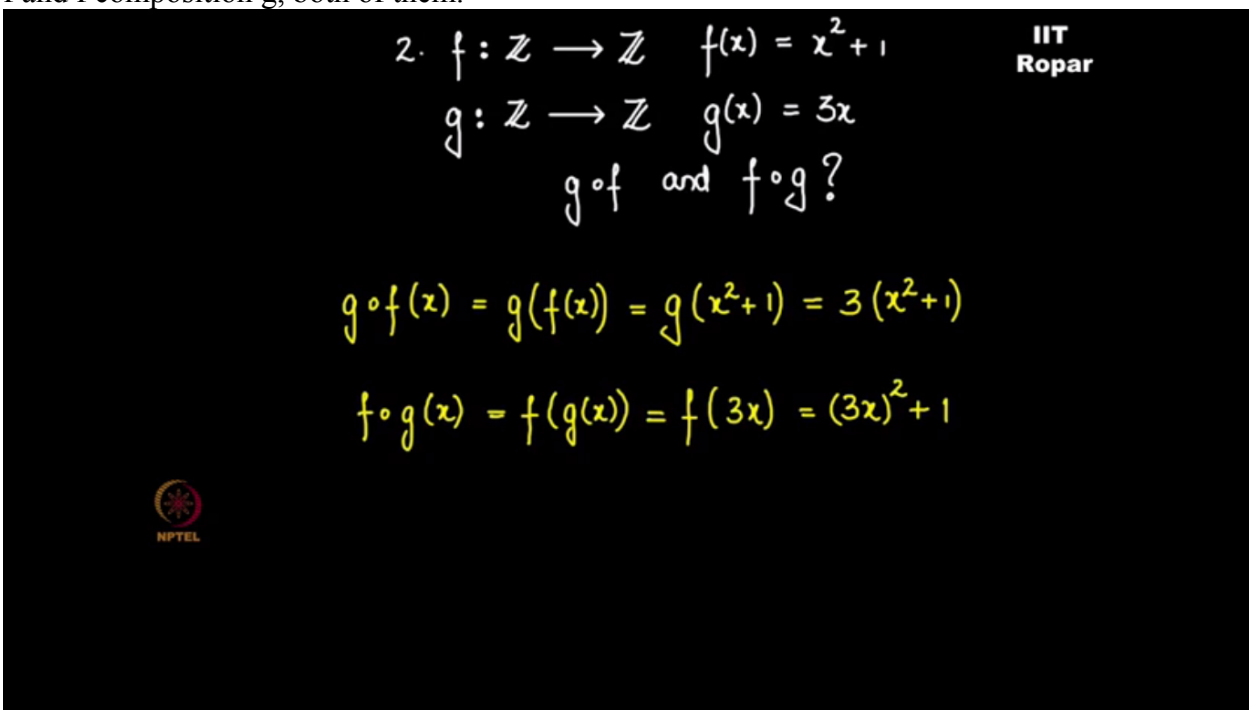


Now what is g(x)? It is modulus of x and f(x) is x^2 and hence f(g(x)) happens to be f of modulus of x. And this is going to be my term now and hence f of modulus of x will be modulus of x the whole square. Correct? Yes.



Now I will end this problem by asking a nice question. Is f composition g same as g composition f? I leave it to you to try out. You may want to compute g composition f and try proving that both of them are not the same.

The last question. Consider this function f from integers to integers defined as $f(x) = x^2 + 1$ and the function g defined from again integers to integers as $g(x) = 3x$. Let us compute g composition f and f composition g, both of them.



g composition f is given to be g composition f(x), which is g(f(x)), which is equal to g of what is f(x)? It is x^2+1. Now if this is going to be my term in the domain of g, then what is g of this term? Let's say this is y. So what is g(y) going to be? It is going to be 3y. So y is x^2+1 and hence it is $3(x^2+1)$.

What is f composition g? f composition g(x) is equal to f(g(x). g(x) is 3x. Now this is my y here. What is f(y)? f(y) is x^2+1. Okay. Let me say f(z) because I have already used y. So f(z) is z^2+1 and what is my z here. It is 3x actually. I can substitute 3x as z and hence f composition g(x) is $(3x)^2 + 1$.

This is my answer and hence what did we observe? g composition f is $3(x^2+1)$ and f composition g is $(3x)^2 + 1$.

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