Algebra II Lesson 9.4

Operations with Functions

Functions may be added, subtracted, multiplied, and divided. That is: f(x)+g(x) is a legitimate action. An airplane for example has an airspeed of 415 mph; f(x) = 415x represents the distance traveled in x hours. With winds of let's say 30 mph we get g(x) = 30x. By combining these equations: f(x) + g(x) = 415x + 30x, we get a model of the distance the plane will travel in 30mph winds.

Function Operations:

(f-g)(x) = f(x) - g(x)(f+g)(x) = f(x) + g(x) $(f \div g)(x) = f(x) \div g(x)$ $(f \cdot g)(x) = f(x) \cdot g(x)$ Our math operations hold true for functions. The domain of x will be that of f and g. Understand that the more restrictive domain will override. Also, keep in mind that for division, a restriction will be that $g(x) \neq 0$.

If we can combine functions, why not put one function **inside** another? The process of putting one function inside another is called "composition of functions." The symbol, o, is used to show composition. In mathematical terms, $f \circ g = f(g(x))$. This means that the function g(x) was put inside the function, f(x).

For example, Joe earns a salary of x dollars a month. Taxes and other deductions, which total \$550, are taken out and are modeled by: h(x) = x - 550. This new total h(x) is after tax dollars, or take home pay. From his take home pay, Joe has to pay bills totaling \$940, these include utilities, food, rent, etc. with an equation of g(x) = h(x) - h(x)940, that is, take home pay less expenses In the composition format, h(x) is put into g(x) to find how much Joe will have left after taxes and bills are paid. Mathematically, g o h(x) = q[h(x)]. Let's consider the case where Joe earns \$1800 a month. How does the composition function work?

$g \circ h(x) = g[h(x)]$	
$g \circ h(1800) = g[h(1800)]$	where $x = 1800$
= g(1800 - 550)	where: $h(x) = x - 550$
= g(1250)	
= 1250 - 940	where: $g(x) = h(x) - 940$
= 310	\$310 is left in the bank

Example:

Given: $f(x) = x^2 + 3x - 2$ and g(x) = 2x - 5 find $f \circ g(-3) = f(g(-3))$

- 1. Work from the inside out.
- 2. Solve for g(-3) first
- 3. The solution for g(-3) is plugged into f(x) and solved for f(x):