Composition of functions NAME:

This worksheet will provide practice for composing two functions.

Remember that $(f \circ g)(x)$ is just a way to write $f(g(x))$ and that is interpreted as "the function *f* evaluated at the value *g*(*x*)".

This is similar to our interpretation of *f*(4), the function *f* evaluated at 4. Back when we were finding stuff like *f*(4), we simply plugged 4 in for the *x*'s into the *f*(*x*) formula and simplified.

We will do the same thing to find $f(g(x))$; we will plug whatever *g*(*x*) is in for the *x*'s into the *f*(*x*) formula and simplify.

1. Let $f(x) = -3x + 7$ and $g(x) = 2x^2 - 8$.

a.) Find and simplify $f(g(x))$.

b.) Find and simplify $(g \circ f)(x)$.

2. Let $h(x) = 4x^2$ and $g(x) = \dfrac{5x}{x+2}$.

a.) Find and simplify $(h \circ g)(x)$.

b.) Find and simplify $g(h(x))$.

3. The number of cars N (per day) produced at a factory after t hours of operation is given by $N(t) = 100t - 5t^2$ where t varies from 0 to 10. If the cost C (in dollars) of producing N cars is $C(N) = 15000 + 8000N$, **find the cost as a function of time**. In other words, find the relationship between t hours of operation and the cost C. Simplify your answer.

HINT: You will use the fact that you know how the number of hours of operation affects the number of cars produced. In turn, you know how the number of cars produced affects the total cost of their operation. Combining these two relationships is what composition is all about.

Let's check the answer from above. We'll find the cost of running the factory 9 hours per day two different ways.
a.) Use your formula from above to find the cost of running the factory 9 hours per day.

b.) Now, use the given $N(t)$ formula to find the number of cars they would produce in 9 hours.

c.) Put your answer to part *b* into the given $C(N)$ formula to find the cost of producing that many cars. Does this match your answer to part *a*?

One cool thing about composition is that it eliminates the middle step. You go straight from hours of operation to cost, without figuring the number of cars in the middle. Part *a* above combines the two parts *b* and *c* into one step.

4. Let $f(x) = 2x - 5$ and $g(x) = .5(x+5)$. Show that $f(g(x)) = x$ and $g(f(x)) = x$.

5. Let $f(x) = \dfrac{4x^2 + 5}{3}$ and $g(x) = -3x + 7$. Find the following.

a.) $f(g(x))$

b.) $f(g(2))$

c.) $f(g(-3))$