Functions: Composition and operations NAME:

This worksheet will provide practice for adding, subtracting, dividing, and composing two functions. We will also investigate domains.

1. Let $f(x) = \sqrt{5x+7} - 4x$ and $g(x) = 4x - 10$. Perform the desired operations. Simplify your answers.

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

b.) $f(x) - g(x)$

c.) $\frac{f(x)}{g(x)}$

2. Let's find the domains of the three functions we found in question 1. We need to first consider the domains of f and g.

a.) What is the domain of $f(x) = \sqrt{5x+7} - 4x$? (Hint: Remember, we can only square root non-negative numbers. Solve the inequality $5x + 7 \geq 0$ to find the domain.)

b.) What is the domain of $g(x) = 4x - 10$? (Remember, we would exclude x values that would make us square root negative numbers or divide by zero. There are no divisions or square roots here. So what's the domain?)

c.) The domain of both $f(x) + g(x)$ and $f(x) - g(x)$ will be the numbers that are in **both** the domains of f and g. So, what is the domain of $f(x) + g(x)$ and $f(x) - g(x)$?

d.) The domain of $\frac{f(x)}{g(x)}$ are the numbers that are in both the domains of f and g and also, do not make g zero. If that happens, then we'd be dividing by zero and we can't do that. What's the domain of $\frac{f(x)}{g(x)}$? (Hint: Solve the equation $0 = 4x - 10$ to find the values that make g zero.)

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

4. 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 $C(N) = 15000 + 8000N$, use composition to find the cost as a function of time. Simplify your answer.

5. Let's check the answer from above. We'll find the cost of running the factory 9 hours per day using two different methods.

a.) Use the given $N(t)$ formula to find the number of cars they would produce in 9 hours.

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

c.) Use your composed formula from question 4 to find the cost of running the factory 9 hours per day. Does this match your answer to part *b*?

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. Our formula from question 4 combines parts *a* and *b* from question 5 into one step.

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

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

b.) $f(g(x))$

c.) $f(g(5))$ [Hint: You can do this problem how you likely did part *a* or you can use the formula you found in part *b*.]

d.) $f(5) + g(5)$ [How is this different than $f(g(5))$?]