Lesson 6.6 Function Operations (Clickers)

Essential Understanding: You can add, subtract, multiply, and divide functions based on how you perform these operations for real numbers. One difference, however is that you must consider the domain of each function.

Key Concepts **Function Operations**

Addition	$(f+g)(x) = f(x) + g(x)$
Subtraction	$(f-g)(x) = f(x) - g(x)$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$

The domains of the sum, difference, product, and quotient functions consist of the x-values that are in the domains of *both* f and g. Also, the domain of the quotient function does not contain any x-value for which $g(x) = 0$.

Ex. Let $f(x) = 4x + 7$ and $g(x) = \sqrt{x} + x$. What are $f + g$ and $f - g$? What are their domains?

Ex. Let $f(x) = 2x^2 + 8$ and $g(x) = x - 3$. What are $f + g$ and $f - g$? What are their domain?

1 Let f(x) = 5x^3 + 1 and g(x) = x^2 - 4. What is f + g?

2 Let $f(x) = 5x^3 + 1$ and $g(x) = x^2 - 4$. What is $f - g$?

Ex. Let $f(x) = x^2 - 9$ and $g(x) = x + 3$. What are $f*g$ and f/g and their domains?

3 Let $f(x) = 3x^2 - 11x - 4$ and $g(x) = 3x + 1$. What is $f*g$?

4 Let $f(x) = 3x^2 - 11x - 4$ and $g(x) = 3x + 1$. What is f/g?

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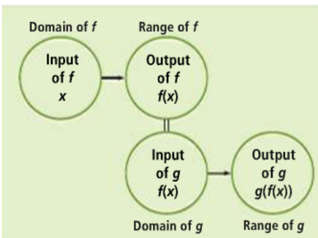
The diagram below shows what happens when you apply one function g(x) after another function f(x).

The output from the first function becomes the input for the second function. When you combine two functions as in the diagram you form a composite function.



Key Concept Composition of Functions

The composition of function g with function f is written as $g \circ f$ and is defined as $(g \circ f)(x) = g(f(x))$. The domain of $g \circ f$ consists of the x-values in the domain of f for which $f(x)$ is in the domain of g.

$(g \circ f)(x) = g(f(x))$

1. Evaluate $f(x)$ first.
2. Then use $f(x)$ as the input for g.

Function composition is not commutative since $f(g(x))$ does not always equal $g(f(x))$.

Ex. Let $f(x) = x - 5$ and $g(x) = x^2$. What is $(g \circ f)(-3)$?

Ex. Let $f(x) = x^2 + 1$ and $g(x) = x - 2$. What is $(g \circ f)(-2)$?

What is $(f \circ g)(-2)$?

5 Let $f(x) = 2x$ and $h(x) = x^2 + 4$. Find $(f \circ h)(-3)$.

Ex. Let $f(x) = 5x - 2$ and $g(x) = x^3 - 5$. Find $(f \circ g)(a)$.

6 Let $f(x) = x^2 + 3$ and $g(x) = x - 4$. Find $(f \circ g)(a)$.

Ex. You have a coupon good for \$5 off the price of any large pizza. You also get a 10% discount on any pizza if you show your student ID. How much more would you pay for a large pizza if the cashier applies the coupon first? (hint: write a function for each discount then compose the functions both way.Then find the difference in their results.)

Ex. A store is offering a 15% discount on all items. Also, employees get a 20% employee discount. Write composite function to model taking the 15% discount and then the 20% discount. Then write a composite function to model taking the 20% discount and then the 15% discount. If you were an employee, which discount would you take first? Why?