4.3 Composition of Functions

Problem 1 Adding and Subtracting Functions

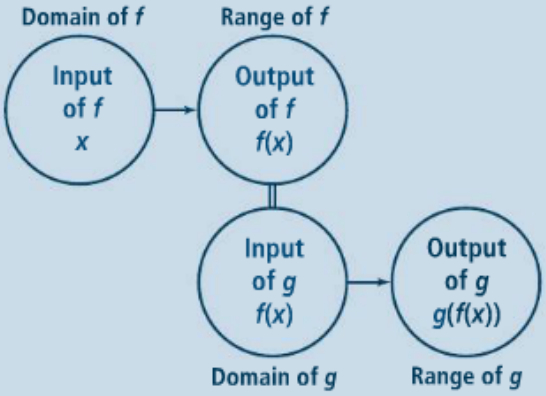
Got It? Let $f(x) = 2x^2 + 8$ and $g(x) = x - 3$. What are $f + g$ and $f - g$? What are their domains?

Problem 2 Multiplying and Dividing Functions

Got It? Let $f(x) = 3x^2 - 11x - 4$ and $g(x) = 3x + 1$. What are $f \cdot g$ and $\frac{f}{g}$ and their domains?

The diagram 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**.



take note

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 $g(f(x))$.

Problem 3 Composing Functions

Got It? What is $(f \circ g)(-3)$ for the functions $f(x) = x - 5$ and $g(x) = x^2$?

Practice

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

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

Problem 4 Using Composite Functions

Got It? A store is offering a 15% discount on all items. Also, employees get a 20% employee discount. Write a composite function

a. to model taking the 15% discount and then the 20% discount.

b. to model taking the 20% discount and then the 15% discount.

c. Reasoning If you were an employee, which discount would you take first? Why?

Practice

7. Sales A computer store offers a 5% discount off the list price x for any computer bought with cash, rather than put on credit. At the same time, the manufacturer offers a $200 rebate for each purchase of a computer.

a. Write a function $f(x)$ to represent the price after the cash discount.

b. Write a function $g(x)$ to represent the price after the $200 rebate.

c. Suppose the list price of a computer is $1500. Use a composite function to find the price of the computer if the discount is applied before the rebate.

d. Suppose the list price of a computer is $1500. Use a composite function to find the price of the computer if the rebate is applied before the discount.