

# Algebra 2

Notes Section 6.6  
Function Operations

Name \_\_\_\_\_

Date \_\_\_\_\_ Hour \_\_\_\_\_

Take note

## 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  $g(x) = 0$ .

**Example 1** Let  $f(x) = 2x^2 + 8$  and  $g(x) = x - 3$ . Perform each function operation and then find the domain of the result.

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

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

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

**Example 2** Let  $f(x) = 3x^2 - 11x - 4$  and  $g(x) = 3x + 1$ . Perform each function operation and then find the domain of the result.

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

b.  $\left(\frac{f}{g}\right)(x)$

c.  $2f(x) - g(x) - 3$

**Example 3** Evaluate the function  $f$  for the given value.  $f(x) = x^2 - 3x + 5$  for  $f(-6)$



Let  $f(x) = 7x + 5$  and  $g(x) = x^2$ . Perform each function operation and then find the domain of the result.

◆ See Problems 1 and 2.

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

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

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

12.  $(f \cdot g)(x)$

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

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

Let  $f(x) = 2 - x$  and  $g(x) = \frac{1}{x}$ . Perform each function operation and then find the domain of the result.

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

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

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

18.  $(f \cdot g)(x)$

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

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

Let  $f(x) = 2x^2 + x - 3$  and  $g(x) = x - 1$ . Perform each function operation and then find the domain.

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

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

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

24.  $(f \cdot g)(x)$

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

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

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  $g$ .

$$(g \circ f)(x) = g(\underbrace{f(x)}_y)$$

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  $g(f(x))$ .

**Example 4** Let  $f(x) = x - 5$  and  $g(x) = x^2$ . Find each value or expression.

a.  $(f \circ g)(x)$                       b.  $(f \circ g)(-3)$                       c.  $(g \circ f)(-3)$

Let  $g(x) = 2x$  and  $h(x) = x^2 + 4$ . Find each value or expression.

See Problem 3.

27.  $(h \circ g)(1)$

28.  $(h \circ g)(-5)$

29.  $(h \circ g)(-2)$

30.  $(g \circ h)(-2)$

31.  $(g \circ h)(0)$

32.  $(g \circ h)(a)$

33.  $(g \circ g)(a)$

34.  $(h \circ h)(a)$

35.  $(h \circ g)(a)$

Let  $f(x) = x^2$  and  $g(x) = x - 3$ . Find each value or expression.

36.  $(g \circ f)(-2)$

37.  $(f \circ g)(-2)$

38.  $(g \circ f)(0)$

39.  $(f \circ g)(0)$

40.  $(g \circ f)(3.5)$

41.  $(f \circ g)(3.5)$

42.  $(f \circ g)(a)$

43.  $(g \circ f)(-a)$

44.  $(f \circ g)(-a)$

Let  $f(x) = 2x + 5$  and  $g(x) = x^2 - 3x + 2$ . Perform each function operation and then find the domain.

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

48.  $3f(x) - 2$

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

50.  $-2g(x) + f(x)$

51.  $f(x) - g(x) + 10$

52.  $4f(x) + 2g(x)$

53.  $-f(x) + 4g(x)$

54.  $f(x) - 2g(x)$

55.  $f(x) \cdot g(x)$

56.  $-3f(x) \cdot g(x)$

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

58.  $\frac{5f(x)}{g(x)}$

Let  $g(x) = 3x + 2$  and  $f(x) = \frac{x-2}{3}$ . Find each value.

63.  $f(g(1))$

64.  $g(f(-4))$

65.  $f(g(0))$

66.  $g(f(2))$

67.  $g(g(0))$

68.  $(g \circ g)(1)$

69.  $(f \circ g)(-2)$

70.  $(f \circ f)(0)$

**Example 5** Find  $f(g(x))$  and  $g(f(x))$  for  $f(x) = 2x^2 - 1$  and  $g(x) = 3x$

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

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

For each pair of functions, find  $f(g(x))$  and  $g(f(x))$ .

72.  $f(x) = 3x, g(x) = x^2$

73.  $f(x) = x + 3, g(x) = x - 5$

74.  $f(x) = 3x^2 + 2, g(x) = 2x$

75.  $f(x) = \frac{x-3}{2}, g(x) = 2x - 3$

76.  $f(x) = -x - 7, g(x) = 4x$

77.  $f(x) = \frac{x+5}{2}, g(x) = x^2$

**Example 6** 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?

60. Suppose your teacher offers to give the whole class a bonus if everyone passes the next math test. The teacher says she will give everyone a 10-point bonus and increase everyone's grade by 9% of their score.
- You earned a 75 on the test. Would you rather have the 10-point bonus first and then the 9% increase, or the 9% increase first and then the 10-point bonus?
  - Reasoning** Is this the best plan for all students? Explain.