2. Function Notation

Functions are often given names, like “f,” “g,” or “h.” The notation \( f(x) \) represents the output of a function named \( f \) when \( x \) is the input. It is pronounced “\( f \) of \( x \).” The notation \( g(2) \), pronounced “\( g \) of 2,” represents the output of function \( g \) when \( x = 2 \).

Substitution can be used to evaluate a function given in function notation. For example, if \( g(x) = 2(x + 3)^2 \), then:

\[
g(-5) = 2(-5 + 3)^2 = 2(-2)^2 = 8 \\
g(a + 1) = 2((a + 1) + 3)^2 = 2(a + 4)^2 = 2(a^2 + 8a + 16) = 2a^2 + 16a + 32
\]

Solution to problem 2-70:

Let \( f(x) = 4x + 7 \) and \( g(x) = x^2 - 3 \).

a. \( f(12) - g(2) = \\
(4(12) + 7) - (2^2 - 3) = \\
55 - 1 = 54 \\
b. \( g(f(-1)) = \\
g(4(-1) + 7) = \\
g(3) = (3)^2 - 3 = 6 \\
c. \( f(w + 2) = \\
4(w + 2) + 7 = \\
4w + 8 + 7 = 4w + 15 \\
d. \( g(k + 5) = \\
(k + 5)^2 - 3 = \\
k^2 + 10k + 25 - 3 = k^2 + 10k + 22 \\

Determine each of the following values or expressions.

1. \( f(x) = 3x^2 + 5 \); evaluate \( f(4) \).
2. \( g(x) = 5x^3 + 3x^2 \); evaluate \( g(-3) \).
3. \( h(x) = 16 \cdot 3^x \); evaluate \( h(2) \).
4. \( f(x) = 5 \cdot 2^{3x} \); evaluate \( f(-1) \).
5. \( g(x) = -9x^2 - 2x \); evaluate \( g(m - 4) \).
6. \( h(x) = 5x^2 + 3x \); evaluate \( h(x + a) \).
7. \( f(x) = -x^2 + 15x \); evaluate \( f(2h) \).
8. \( j(x) = 3x^2 + 5x \) and \( f(x) = 2x^2 - 2x + 3 \); evaluate \( j(f(1)) \).
9. \( f(x) = 6x^3 + 7 \) and \( g(x) = 3^x \); evaluate \( f(g(-2)) \).
10. \( h(x) = 3x^2 - 4x - 5 \) and \( m(x) = x^2 + x + 1 \); evaluate \( m(h(3)) \).
11. \( n(x) = 5x^2 + 5x + 5 \) and \( d(x) = 4x + 4 \); evaluate \( n(d(x)) \).
12. \( f(x) = 7x + 6 \); evaluate \( f(f(x)) \).
Answers

1. 53   2. –108
3. 944,784   4. \( \frac{5}{8} \)
5. \(-9m^2 + 70m - 136\)   6. \(5x^2 + 10xa + 5a^2 + 3x + 3a\)
7. \(-4h^2 + 30h\)   8. 42
9. \(7 \frac{2}{243}\)   10. 111
11. \(80x^2 + 180x + 105\)   12. \(49x + 48\)