EXERCISE 10-1

A **1.** Name the inverse operation of each of the following.

a. addition b. subtraction c. multiplication
d. division e. exponentiation f. taking logarithms
g. differentiation h. antidifferentiation

2. Complete each of the following statements.

a. An antiderivative of the sum of two functions is . . . .
b. An antiderivative of the difference of two functions is . . . .

3. What is an antiderivative of zero?

B **4.** Each of the following is a derivative of an expression. Find the original expression.

a. $x^{\frac{1}{2}}$ b. $x^{\frac{3}{2}}$ c. $x^{-\frac{1}{2}}$
d. $x^{-\frac{5}{2}}$ e. $x^{\frac{1}{3}} + x^{\frac{4}{3}}$ f. $x^{\frac{1}{4}} + x^{-\frac{5}{4}}$

5. Each of the following is a derivative of a polynomial. Find the original expression.

a. $x^2 + 3x - 1$ b. $2x^3 - 4x + 7$ c. $5x^4 - 4x^3 + 3x^2$
d. $x^{11} + x^7 + x^3$ e. $-x - x^2 - x^4$ f. $x^{100} + x^{200} + x^{300}$

6. Find an antiderivative expression for each of the following.

a. $1 + 2x$ b. $\sqrt{1 + 2x}$ c. $(1 + 2x)^{\frac{3}{2}}$
d. $(1 + 2x)^2$ e. $(1 + 2x)^{10}$ f. $(1 + 2x)^{-3}$

7. Each of the following expressions is a derivative of a function. Find the original function.

a. $\cos 5x$ b. $\sin(4x - 3)$ c. $\sin(4 - 11x)$
d. $\cos(5 - 17x)$ e. $2 \sin x \cos x$ f. $1 + \tan^2 3x$

8. Find an antiderivative expression for each of the following.

a. e^{2x} b. $e^{-4x} - e^{-8x}$ c. $2^x + 2^{-x}$
d. $3^x + 5^x$ e. $10^x - 10^{-x}$ f. $(2^x - 2^{-x})^2$

9. An automobile starts from the origin at time $t = 0$. How many kilometres has the car travelled if, after t hours, its velocity is each of the following (in km/h)?

a. 50 b. $10 + 20t$ c. $40 + 10 \sin t$
d. $90 + \cos\left(\frac{t}{10}\right)$ e. $e^{-\frac{t}{100}}$ f. e^{100t}

C **10.** For each of the following, construct a function that is continuous for all $x \in R$, including the origin, and that has each of the following functions as its derivative for $x \neq 0$.

a. $0\,(x < 0),\ 1\,(x > 0)$ b. $-1\,(x < 0),\ 1\,(x > 0)$ c. $0\,(x < 0),\ x\,(x > 0)$
d. $0\,(x < 0),\ \cos x\,(x > 0)$ e. $-x\,(x < 0),\ x\,(x > 0)$ f. $-x^n\,(x < 0),\ x^n\,(x > 0)$