Fill in each blank so that the resulting statement is true.

1. $\{a_n\} = a_1, a_2, a_3, a_4, \ldots, a_n, \ldots$ represents an infinite ________, a function whose domain is the set of positive ________. The function values $a_1, a_2, a_3, \ldots$ are called the ________.

2. The nth term of a sequence, represented by a_n, is called the ________ term.

Write the second term of each sequence.

3. $a_n = 5n - 6$ ____

4. $a_n = \dfrac{(-1)^n}{4^n - 1}$ ____

5. $a_n = 2a_{n-1} - 4, a_1 = 3$ ____

6. 5!, called 5 ________, is the product of all positive integers from ____ down through ____. By definition, $0! =$ ____.

7. $\dfrac{(n+3)!}{(n+2)!} =$ ______

8. $\sum_{i=1}^{n} a_i =$ ____ + ____ + ____ + ⋯ + ____. In this summation notation, i is called the ______ of summation, n is the ________ of summation, and 1 is the ________ of summation.

EXERCISE SET 8.1

Practice Exercises

In Exercises 1–12, write the first four terms of each sequence whose general term is given.

1. $a_n = 3n + 2$
2. $a_n = 4n - 1$
3. $a_n = 3^n$
4. $a_n = \left(\frac{1}{3}\right)^n$
5. $a_n = (-3)^n$
6. $a_n = \left(-\frac{1}{3}\right)^n$
7. $a_n = (-1)^n(n+3)$
8. $a_n = (-1)^{n+1}(n+4)$
9. $a_n = \dfrac{2n}{n+4}$
10. $a_n = \dfrac{3n}{n+5}$
11. $a_n = \dfrac{(-1)^{n+1}}{2^n - 1}$
12. $a_n = \dfrac{(-1)^{n+1}}{2^n + 1}$

The sequences in Exercises 13–18 are defined using recursion formulas. Write the first four terms of each sequence.

13. $a_1 = 7$ and $a_n = a_{n-1} + 5$ for $n \ge 2$
14. $a_1 = 12$ and $a_n = a_{n-1} + 4$ for $n \ge 2$
15. $a_1 = 3$ and $a_n = 4a_{n-1}$ for $n \ge 2$
16. $a_1 = 2$ and $a_n = 5a_{n-1}$ for $n \ge 2$
17. $a_1 = 4$ and $a_n = 2a_{n-1} + 3$ for $n \ge 2$
18. $a_1 = 5$ and $a_n = 3a_{n-1} - 1$ for $n \ge 2$

In Exercises 19–22, the general term of a sequence is given and involves a factorial. Write the first four terms of each sequence.

19. $a_n = \dfrac{n^2}{n!}$
20. $a_n = \dfrac{(n+1)!}{n^2}$
21. $a_n = 2(n+1)!$
22. $a_n = -2(n-1)!$

In Exercises 23–28, evaluate each factorial expression.

23. $\dfrac{17!}{15!}$
24. $\dfrac{18!}{16!}$
25. $\dfrac{16!}{2!14!}$
26. $\dfrac{20!}{2!18!}$
27. $\dfrac{(n+2)!}{n!}$
28. $\dfrac{(2n+1)!}{(2n)!}$

In Exercises 29–42, find each indicated sum.

29. $\sum_{i=1}^{6} 5i$
30. $\sum_{i=1}^{6} 7i$
31. $\sum_{i=1}^{4} 2i^2$
32. $\sum_{i=1}^{5} i^3$
33. $\sum_{k=1}^{5} k(k+4)$
34. $\sum_{k=1}^{4} (k-3)(k+2)$
35. $\sum_{i=1}^{4} \left(-\frac{1}{2}\right)^i$
36. $\sum_{i=2}^{4} \left(-\frac{1}{3}\right)^i$
37. $\sum_{i=5}^{9} 11$
38. $\sum_{i=3}^{7} 12$
39. $\sum_{i=0}^{4} \dfrac{(-1)^i}{i!}$
40. $\sum_{i=0}^{4} \dfrac{(-1)^{i+1}}{(i+1)!}$
41. $\sum_{i=1}^{5} \dfrac{i!}{(i-1)!}$
42. $\sum_{i=1}^{5} \dfrac{(i+2)!}{i!}$

In Exercises 43–54, express each sum using summation notation. Use 1 as the lower limit of summation and i for the index of summation.

43. $1^2 + 2^2 + 3^2 + \cdots + 15^2$
44. $1^4 + 2^4 + 3^4 + \cdots + 12^4$
45. $2 + 2^2 + 2^3 + \cdots + 2^{11}$
46. $5 + 5^2 + 5^3 + \cdots + 5^{12}$
47. $1 + 2 + 3 + \cdots + 30$
48. $1 + 2 + 3 + \cdots + 40$
49. $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \cdots + \frac{14}{14+1}$