9.1 Exercises

The *Interactive* CD-ROM and *Internet* versions of this text contain step-by-step solutions to all odd-numbered exercises. They also provide Tutorial Exercises for additional help.

In Exercises 1–24, write the first five terms of the sequence. (Assume that n begins with 1.)

1. $a_n = 3n + 1$
2. $a_n = 5n - 3$
3. $a_n = 2^n$
4. $a_n = \left(\frac{1}{2}\right)^n$
5. $a_n = (-2)^n$
6. $a_n = \left(-\frac{1}{2}\right)^n$
7. $a_n = \dfrac{n+2}{n}$
8. $a_n = \dfrac{n}{n+2}$
9. $a_n = \dfrac{6n}{3n^2 - 1}$
10. $a_n = \dfrac{3n^2 - n + 4}{2n^2 + 1}$
11. $a_n = \dfrac{1 + (-1)^n}{n}$
12. $a_n = 1 + (-1)^n$
13. $a_n = 2 - \dfrac{1}{3^n}$
14. $a_n = \dfrac{2^n}{3^n}$
15. $a_n = \dfrac{1}{n^{3/2}}$
16. $a_n = \dfrac{10}{n^{2/3}}$
17. $a_n = \dfrac{3^n}{n!}$
18. $a_n = \dfrac{n!}{n}$
19. $a_n = \dfrac{(-1)^n}{n^2}$
20. $a_n = (-1)^n\left(\dfrac{n}{n+1}\right)$
21. $a_n = \frac{2}{3}$
22. $a_n = 0.3$
23. $a_n = n(n-1)(n-2)$
24. $a_n = n(n^2 - 6)$

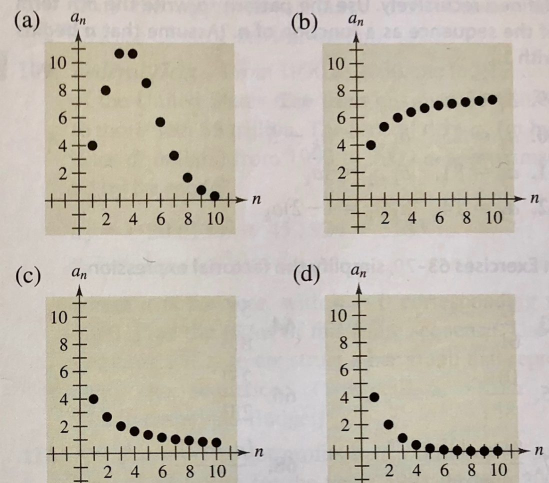
In Exercises 25–30, find the indicated term of the sequence.

25. $a_n = (-1)^n(3n - 2)$
 $a_{25} =$
26. $a_n = (-1)^{n-1}[n(n-1)]$
 $a_{16} =$
27. $a_n = \dfrac{2^n}{n!}$
 $a_{10} =$
28. $a_n = \dfrac{n!}{2n}$
 $a_8 =$
29. $a_n = \dfrac{4n}{2n^2 - 3}$
 $a_{11} =$
30. $a_n = \dfrac{4n^2 - n + 3}{n(n-1)(n+2)}$
 $a_{13} =$

In Exercises 31–36, use a graphing utility to graph the first 10 terms of the sequence.

31. $a_n = \dfrac{3}{4}n$
32. $a_n = 2 - \dfrac{4}{n}$
33. $a_n = 16(-0.5)^{n-1}$
34. $a_n = 8(0.75)^{n-1}$
35. $a_n = \dfrac{2n}{n+1}$
36. $a_n = \dfrac{n^2}{n^2 + 2}$

In Exercises 37–40, match the sequence with the graph of its first 10 terms. [The graphs are labeled (a), (b), (c), and (d).]



37. $a_n = \dfrac{8}{n+1}$
38. $a_n = \dfrac{8n}{n+1}$
39. $a_n = 4(0.5)^{n-1}$
40. $a_n = \dfrac{4^n}{n!}$

In Exercises 41–54, write an expression for the *apparent* nth term of the sequence. (Assume that n begins with 1.)

41. 1, 4, 7, 10, 13, . . .
42. 3, 7, 11, 15, 19, . . .
43. 0, 3, 8, 15, 24, . . .
44. 2, −4, 6, −8, 10, . . .
45. $\frac{-2}{3}, \frac{3}{4}, \frac{-4}{5}, \frac{5}{6}, \frac{-6}{7}, \ldots$
46. $\frac{1}{2}, \frac{-1}{4}, \frac{1}{8}, \frac{-1}{16}, \ldots$
47. $\frac{2}{1}, \frac{3}{3}, \frac{4}{5}, \frac{5}{7}, \frac{6}{9}, \ldots$
48. $\frac{1}{3}, \frac{2}{9}, \frac{4}{27}, \frac{8}{81}, \ldots$
49. $1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}, \ldots$
50. $1, \frac{1}{2}, \frac{1}{6}, \frac{1}{24}, \frac{1}{120}, \ldots$
51. 1, −1, 1, −1, 1, . . .
52. $1, 2, \frac{2^2}{2}, \frac{2^3}{6}, \frac{2^4}{24}, \frac{2^5}{120}, \ldots$
53. $1 + \frac{1}{1}, 1 + \frac{1}{2}, 1 + \frac{1}{3}, 1 + \frac{1}{4}, 1 + \frac{1}{5}, \ldots$
54. $1 + \frac{1}{2}, 1 + \frac{3}{4}, 1 + \frac{7}{8}, 1 + \frac{15}{16}, 1 + \frac{31}{32}, \ldots$

In Exercises 55–58, write the first five terms of the sequence defined recursively.

55. $a_1 = 28, \quad a_{k+1} = a_k - 4$

56. $a_1 = 15, \quad a_{k+1} = a_k + 3$

57. $a_1 = 3, \quad a_{k+1} = 2(a_k - 1)$

58. $a_1 = 32, \quad a_{k+1} = \frac{1}{2}a_k$

In Exercises 59–62, write the first five terms of the sequence defined recursively. Use the pattern to write the *n*th term of the sequence as a function of *n*. (Assume that *n* begins with 1.)

59. $a_1 = 6, \quad a_{k+1} = a_k + 2$

60. $a_1 = 25, \quad a_{k+1} = a_k - 5$

61. $a_1 = 81, \quad a_{k+1} = \frac{1}{3}a_k$

62. $a_1 = 14, \quad a_{k+1} = (-2)a_k$

In Exercises 63–70, simplify the factorial expression.

63. $\dfrac{4!}{6!}$

64. $\dfrac{5!}{8!}$

65. $\dfrac{10!}{8!}$

66. $\dfrac{25!}{23!}$

67. $\dfrac{(n+1)!}{n!}$

68. $\dfrac{(n+2)!}{n!}$

69. $\dfrac{(2n-1)!}{(2n+1)!}$

70. $\dfrac{(3n+1)!}{(3n)!}$

In Exercises 71–82, find the sum.

71. $\sum_{i=1}^{5} (2i + 1)$

72. $\sum_{i=1}^{6} (3i - 1)$

73. $\sum_{k=1}^{4} 10$

74. $\sum_{k=1}^{5} 5$

75. $\sum_{i=0}^{4} i^2$

76. $\sum_{i=0}^{5} 2i^2$

77. $\sum_{k=0}^{3} \dfrac{1}{k^2 + 1}$

78. $\sum_{j=3}^{5} \dfrac{1}{j^2 - 3}$

79. $\sum_{k=2}^{5} (k+1)^2(k-3)$

80. $\sum_{i=1}^{4} [(i-1)^2 + (i+1)^3]$

81. $\sum_{i=1}^{4} 2^i$

82. $\sum_{j=0}^{4} (-2)^j$

In Exercises 83–86, use a calculator to find the sum.

83. $\sum_{j=1}^{6} (24 - 3j)$

84. $\sum_{j=1}^{10} \dfrac{3}{j+1}$

85. $\sum_{k=0}^{4} \dfrac{(-1)^k}{k+1}$

86. $\sum_{k=0}^{4} \dfrac{(-1)^k}{k!}$

In Exercises 87–96, use sigma notation to write the sum.

87. $\dfrac{1}{3(1)} + \dfrac{1}{3(2)} + \dfrac{1}{3(3)} + \cdots + \dfrac{1}{3(9)}$

88. $\dfrac{5}{1+1} + \dfrac{5}{1+2} + \dfrac{5}{1+3} + \cdots + \dfrac{5}{1+15}$

89. $\left[2\left(\frac{1}{8}\right) + 3\right] + \left[2\left(\frac{2}{8}\right) + 3\right] + \cdots + \left[2\left(\frac{8}{8}\right) + 3\right]$

90. $\left[1 - \left(\frac{1}{6}\right)^2\right] + \left[1 - \left(\frac{2}{6}\right)^2\right] + \cdots + \left[1 - \left(\frac{6}{6}\right)^2\right]$

91. $3 - 9 + 27 - 81 + 243 - 729$

92. $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \cdots - \frac{1}{128}$

93. $\dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \cdots - \dfrac{1}{20^2}$

94. $\dfrac{1}{1 \cdot 3} + \dfrac{1}{2 \cdot 4} + \dfrac{1}{3 \cdot 5} + \cdots + \dfrac{1}{10 \cdot 12}$

95. $\frac{1}{4} + \frac{3}{8} + \frac{7}{16} + \frac{15}{32} + \frac{31}{64}$

96. $\frac{1}{2} + \frac{2}{4} + \frac{6}{8} + \frac{24}{16} + \frac{120}{32} + \frac{720}{64}$

In Exercises 97–100, find the indicated partial sum of the series.

97. $\sum_{i=1}^{\infty} 5\left(\frac{1}{2}\right)^i$, Fourth partial sum

98. $\sum_{i=1}^{\infty} 2\left(\frac{1}{3}\right)^i$, Fifth partial sum

99. $\sum_{n=1}^{\infty} 4\left(-\frac{1}{2}\right)^n$, Third partial sum

100. $\sum_{n=1}^{\infty} 8\left(-\frac{1}{4}\right)^n$, Fourth partial sum

In Exercises 101–104, find the sum of the infinite series.

101. $\sum_{i=1}^{\infty} 6\left(\frac{1}{10}\right)^i$

102. $\sum_{k=1}^{\infty} \left(\frac{1}{10}\right)^k$

103. $\sum_{k=1}^{\infty} 7\left(\frac{1}{10}\right)^k$

104. $\sum_{i=1}^{\infty} 2\left(\frac{1}{10}\right)^i$

105. ***Compound Interest*** A deposit of \$5000 is made in an account that earns 8% interest compounded quarterly. The balance in the account after n quarters is

$$A_n = 5000\left(1 + \frac{0.08}{4}\right)^n, \quad n = 1, 2, 3, \ldots$$

(a) Compute the first eight terms of this sequence.

(b) Find the balance in this account after 10 years by computing the 40th term of the sequence.