

Answers for 12.1

For use with pages 798–800

12.1 Skill Practice

1. sigma notation
2. A sequence is a list of numbers, and a series is the sum of the terms of a sequence.
3. 3, 4, 5, 6, 7, 8
4. 5, 4, 3, 2, 1, 0
5. 1, 4, 9, 16, 25, 36
6. 3, 10, 29, 66, 127, 218
7. 1, 4, 16, 64, 256, 1024
8. $-1, -4, -9, -16, -25, -36$
9. $-4, -1, 4, 11, 20, 31$
10. 16, 25, 36, 49, 64, 81
11. $-4, -2, -\frac{4}{3}, -1, -\frac{4}{5}, -\frac{2}{3}$
12. $3, \frac{3}{2}, 1, \frac{3}{4}, \frac{3}{5}, \frac{1}{2}$
13. $\frac{2}{3}, 1, \frac{6}{5}, \frac{4}{3}, \frac{10}{7}, \frac{3}{2}$
14. $1, \frac{2}{3}, \frac{3}{5}, \frac{4}{7}, \frac{5}{9}, \frac{6}{11}$
15. You can write the terms as $5(1) - 4, 5(2) - 4, 5(3) - 4, 5(4) - 4, a_5 = 21, a_n = 5n - 4$.
16. You can write the terms as $2^{1-1}, 2^{2-1}, 2^{3-1}, 2^{4-1}, a_5 = 16, a_n = 2^{n-1}$.

17. You can write the terms as $(-1)^1(4 \cdot 1), (-1)^2(4 \cdot 2), (-1)^3(4 \cdot 3), (-1)^4(4 \cdot 4), a_5 = -20, a_n = (-1)^n(4 \cdot n)$.
18. You can write the terms as $1^3 + 1, 2^3 + 1, 3^3 + 1, 4^3 + 1, a_5 = 126, a_n = n^3 + 1$.
19. You can write the terms as $\frac{2}{3(1)}, \frac{2}{3(2)}, \frac{2}{3(3)}, \frac{2}{3(4)}, a_5 = \frac{2}{15}, a_n = \frac{2}{3n}$.
20. You can write the terms as $\frac{2(1)}{1+2}, \frac{2(2)}{2+2}, \frac{2(3)}{3+2}, \frac{2(4)}{4+2}, a_5 = \frac{10}{7}, a_n = \frac{2n}{n+2}$.
21. You can write the terms as $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{4}{5}, a_6 = \frac{6}{4}, a_n = \frac{n}{4}$.
22. You can write the terms as $\frac{2(1)-1}{1(10)}, \frac{2(2)-1}{2(10)}, \frac{2(3)-1}{3(10)}, \frac{2(4)-1}{4(10)}, a_5 = \frac{9}{50}, a_n = \frac{2n-1}{10n}$.
23. You can write the terms as $0.7(1) + 2.4, 0.7(2) + 2.4, 0.7(3) + 2.4, 0.7(4) + 2.4, a_5 = 5.9, a_n = 0.7n + 2.4$.

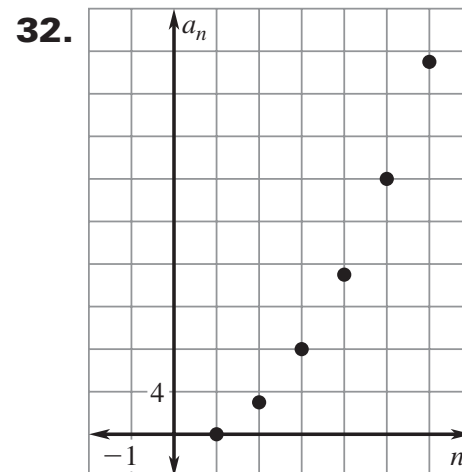
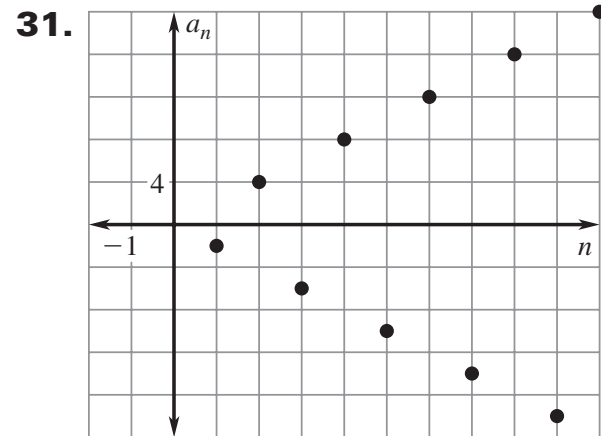
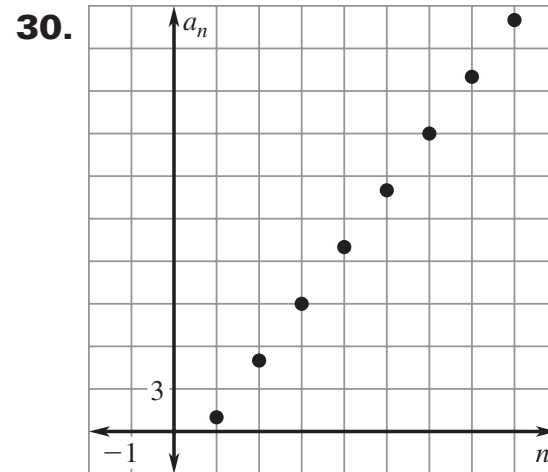
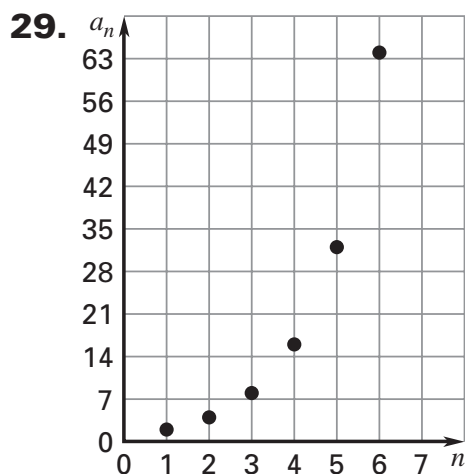
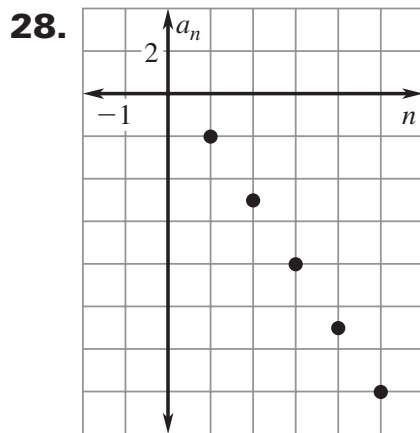
Answers for 12.1 *continued*
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24. You can write the terms as
 $5.8 - 1.6(1)$, $5.8 - 1.6(2)$,
 $5.8 - 1.6(3)$, $5.8 - 1.6(4)$,
 $5.8 - 1.6(5)$, $a_6 = -3.8$,
 $a_n = 5.8 - 1.6n$.

25. You can write the terms as
 $1^2 + 0.2$, $2^2 + 0.2$, $3^2 + 0.2$,
 $4^2 + 0.2$, $a_5 = 25.2$,
 $a_n = n^2 + 0.2$.

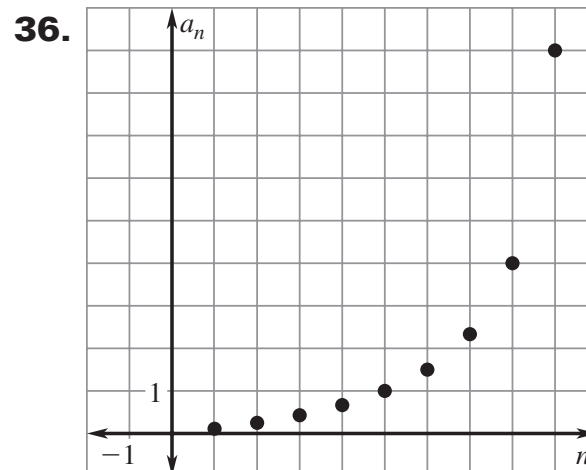
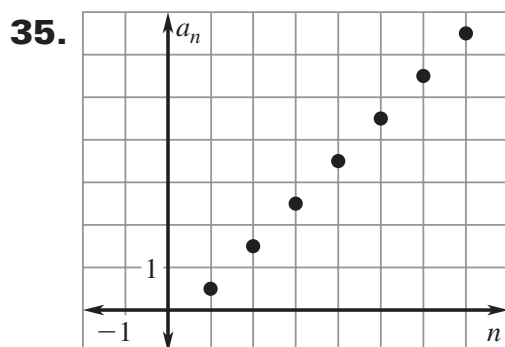
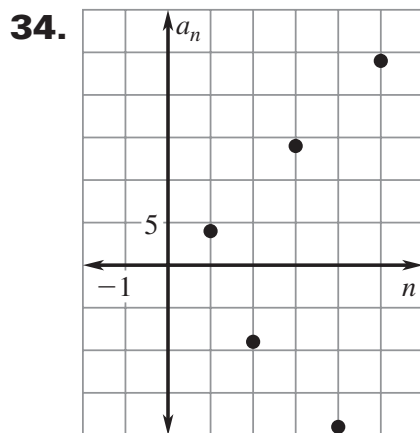
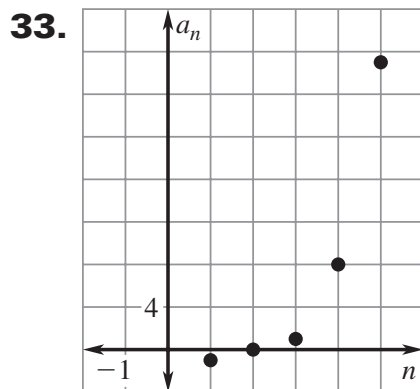
26. You can write the terms as
 $7.8(1) + 1.2$, $7.8(2) + 1.2$,
 $7.8(3) + 1.2$, $7.8(4) + 1.2$,
 $a_5 = 40.2$, $a_n = 7.8n + 1.2$.

27. D



Answers for 12.1 *continued*

For use with pages 798–800



37. $\sum_{i=1}^5 3i + 4$ **38.** $\sum_{i=1}^5 6i + 4$

39. $\sum_{i=1}^{\infty} 2i - 3$ **40.** $\sum_{i=1}^{\infty} (-2)^i$

41. $\sum_{i=1}^{\infty} 7i - 4$ **42.** $\sum_{i=1}^4 \frac{1}{3^i}$

43. $\sum_{i=1}^7 \frac{i}{3+i}$ **44.** $\sum_{i=1}^{\infty} i^2 - 2$

45. 42 **46.** 105 **47.** 100

48. 90 **49.** 82 **50.** 50

51. $\frac{761}{140}$ **52.** $\frac{617}{140}$ **53.** 35

54. 136 **55.** 325 **56.** 2109

57. The lower limit is zero, so the first term should be 3;
 $3 + 5 + 7 + 9 + 11 + 13 = 48$.

58. B

Answers for 12.1 *continued*
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59. true; $\sum_{i=1}^n ka_i = (ka_1 + ka_2 + ka_3 + \dots + ka_n) = k(a_1 + a_2 + a_3 + \dots + a_n) = k \sum_{i=1}^n a_i$

60. true; $\sum_{i=1}^n (a_i + b_i) = (a_1 + b_1) + (a_2 + b_2) + (a_3 + b_3) + \dots + (a_n + b_n) = (a_1 + a_2 + a_3 + \dots + a_n) + (b_1 + b_2 + b_3 + \dots + b_n) = \sum_{i=1}^n a_i + \sum_{i=1}^n b_i$

61. False. *Sample answer:*

$$\sum_{i=1}^4 (2i)(-4i) \neq \left(\sum_{i=1}^4 2i \right) \left(\sum_{i=1}^4 -4i \right)$$

62. False. *Sample answer:*

$$\sum_{i=1}^4 (2x)^2 \neq \left(\sum_{i=1}^4 2x \right)^2$$

12.1 Problem Solving

63. $60^\circ, 90^\circ, 108^\circ, 120^\circ$, about 128.57° ; $T_n = 180(n - 2)$; 1800°

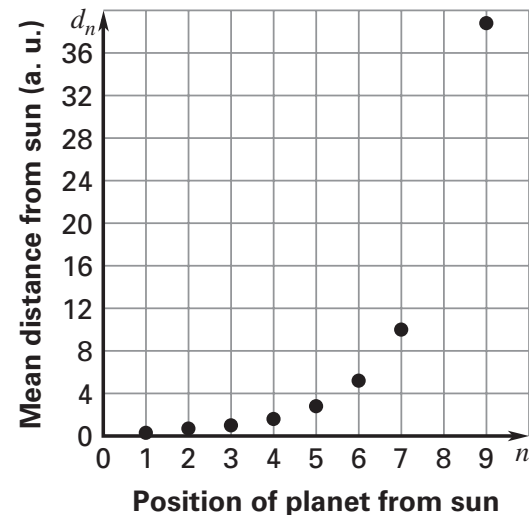
64. \$50.50; 316 days. *Sample answer:* I used the special series formula for the sum of the first n positive integers and set it equal to 50,000 (since there are 50,000 pennies in \$500) and solved.

65. $a_n = 2^n - 1$; 63 moves, 127 moves, 255 moves

66. a. about 1.6 astronomical units

b. about 239,356,592 km

c.



67. a. 15 balls

b. 35 balls

c. Except for layer 1, there are always more balls in the same layer of the square pyramid. The difference in the number of balls is $\frac{n(n-1)}{2}$.

68.

$$S_n = \frac{1}{2} \left(\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2} \right)$$

12.1 Mixed Review

69. 5 **70.** 4 **71.** -2

72. $\frac{5}{4}$ **73.** $\frac{3}{2}$ **74.** 2

Answers for 12.1 *continued*

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75. -3

76. 2

77. -3

78. $2\sqrt{10}$

79. $5\sqrt{2}$

80. $\sqrt{74}$

81. $\sqrt{34}$

82. $\sqrt{17}$

83. 5

84. $\sqrt{17}$

85. $2\sqrt{13}$

86. $\sqrt{205}$

Answers for 12.2

For use with pages 806–809

12.2 Skill Practice

1. common difference
2. An arithmetic sequence is a list of numbers that have the same common difference between consecutive terms. An arithmetic series is the sum of the terms of the arithmetic sequence.
3. Arithmetic; there is a common difference of 3 between consecutive terms.
4. Not arithmetic; there is not a common difference between consecutive terms.
5. Arithmetic; there is a common difference of 9 between consecutive terms.
6. Not arithmetic; there is not a common difference between consecutive terms.
7. Arithmetic; there is a common difference of 0.5 between consecutive terms.
8. Not arithmetic; there is not a common difference between consecutive terms.
9. Not arithmetic; there is not a common difference between consecutive terms.
10. Not arithmetic; there is not a common difference between consecutive terms.
11. Arithmetic; there is a common difference of 1.5 between consecutive terms.
12. $a_n = 3n - 2$; 58
13. $a_n = -1 + 6n$; 119
14. $a_n = -5 + 13n$; 255
15. $a_n = -5 + 2n$; 35
16. $a_n = 10 - 4n$; -70
17. $a_n = 36 - 11n$; -184
18. $a_n = -\frac{2}{3} + \frac{2}{3}n$; $\frac{38}{3}$
19. $a_n = \frac{7}{3} - \frac{1}{3}n$; $-\frac{13}{3}$
20. $a_n = -0.6 + 2.1n$; 41.4
21. The equation for an arithmetic sequence is not correct;
 $a_n = a_1 + (n - 1)d$,
 $a_n = 37 + (n - 1)(-13)$,
 $a_n = 50 - 13n$.
22. The terms were substituted into the wrong places;
 $37 = (n - 1)(-13)$,
 $a_n = 50 - 13n$.
23. $a_n = -28 + 5n$
24. $a_n = -70 + 9n$

Answers for 12.2 *continued*

For use with pages 806–809

25. $a_n = 152 - 14n$

26. $a_n = 81 - 7n$

27. $a_n = -5 + \frac{7}{2}n$

28. $a_n = 6 - \frac{1}{2}n$

29. C

30. $a_n = -5 + 9n$

31. $a_n = 9 + 5n$

32. $a_n = -11 + 3n$

33. $a_n = 22 - 4n$

34. $a_n = 17 + 8n$

35. $a_n = 13 + 2n$

36. $a_n = \frac{111}{5} - \frac{13}{5}n$

37. $a_n = \frac{15}{4} + \frac{9}{4}n$

38. $a_n = \frac{12}{5} - \frac{2}{5}n$

39. B

40. 175 41. -96 42. -774

43. 2585 44. 252 45. 315

46. 450 47. 132 48. 161

49. $a_n = -3 + 5n$

50. $a_n = 2 - 3n$

51. $a_n = -1 - 2n$

52. *Sample answer:* The graph of a_n is just points at every integer n and the graph of $f(x)$ is a line. Both graphs have the same rate of change between points.

53. False. *Sample answer:* Doubling the common difference alone does not double the sum.

54. true; $a + c = 2b$

55. 12 56. 8 57. 25

58. 5 59. 15 60. 9

61. 22,500 62. $\frac{2}{3}, -\frac{8}{3}$

12.2 Problem Solving

63. a. $a_n = 6n$

b. 271 cells

64. $a_n = 1 + 2n$; 63 band members

65. a. $a_n = -4 + 8n$

b. 576 blocks

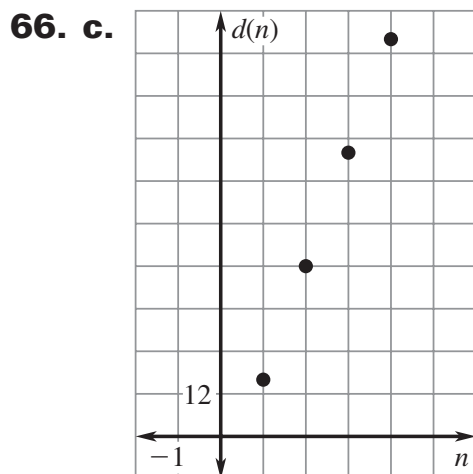
66. a.

n	$d(n)$
1	16
2	48
3	80
4	112

b. $a_n = -16 + 32n$

Answers for 12.2 *continued*

For use with pages 806–809



67. \$100

68. a.

n	d_n (in.)	l_n (in.)
1	2	2π
2	2.0008	2.0008π
3	2.0016	2.0016π
4	2.0024	2.0024π

b. arithmetic;

$$a_n = [2 + 0.0008(n - 1)]\pi$$

c. 3750 times; 41,228.7 in.

d. *Sample answer:* \$2.10; a 5 inch roll costs \$1.50 which breaks down to \$.30 per inch, so a 7 inch roll should cost $7 \cdot 0.3$.

69. $a_1 = \frac{2y}{n} - x$

12.2 Mixed Review

70. 16,807

71. 216

72. 32

73. $3\sqrt[3]{9}$

74. 615

75. 259

76. 3

77. about 2.153

78. about 0.314

79. about 0.029

80. 13

81. $\frac{1}{2}$

82. $6\frac{2}{3}$, 6, 6

83. about 40.4, 43, 43

84. 84.625, 82.5, 92

85. about -1.29 , -2 , none

86. about 2.6, 2.6, 1.9

87. about 3.6, 3.8, none

88. 23 hats

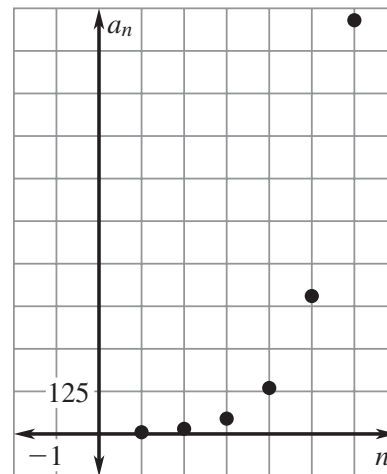
Answers for 12.3

For use with pages 814–818

12.3 Skill Practice

1. common ratio
2. When you divide consecutive terms you have the same ratio.
3. Not geometric; there is no common ratio.
4. Geometric; there is a common ratio of 4.
5. Geometric; there is a common ratio of $\frac{1}{6}$.
6. Geometric; there is a common ratio of 2.
7. Not geometric; there is no common ratio.
8. Not geometric; there is no common ratio.
9. Geometric; there is a common ratio of $\frac{1}{2}$.
10. Not geometric; there is no common ratio.
11. Geometric; there is a common ratio of -3 .
12. Geometric; there is a common ratio of 3.
13. Not geometric; there is no common ratio.

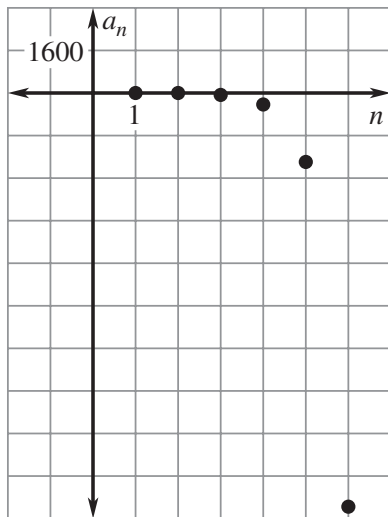
14. Not geometric; there is no common ratio.
15. $a_n = (-4)^{n-1}; 4096$
16. $a_n = 6(3)^{n-1}; 4374$
17. $a_n = 4(6)^{n-1}; 186,624$
18. $a_n = 7(-5)^{n-1}; 109,375$
19. $a_n = 2\left(\frac{3}{4}\right)^{n-1}; \frac{729}{2048}$
20. $a_n = 3\left(-\frac{2}{5}\right)^{n-1}; \frac{192}{15,625}$
21. $a_n = 4\left(\frac{1}{2}\right)^{n-1}; \frac{1}{16}$
22. $a_n = -0.3(-2)^{n-1}; -19.2$
23. $a_n = -2(0.4)^{n-1}; -0.008192$
24. $a_n = 7(-0.6)^{n-1}; 0.326592$
25. $a_n = 5(-2.8)^{n-1}; 2409.45152$
26. $a_n = 120(1.5)^{n-1}; 1366.875$
27. B
28. $a_n = 5(3)^{n-1}$



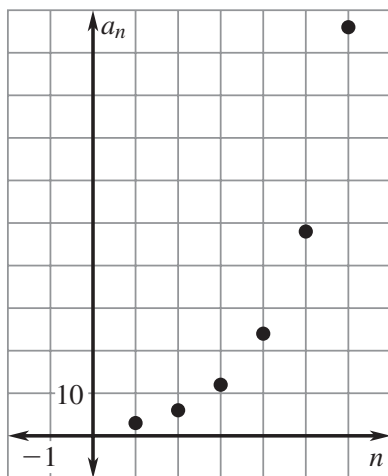
Answers for 12.3 *continued*

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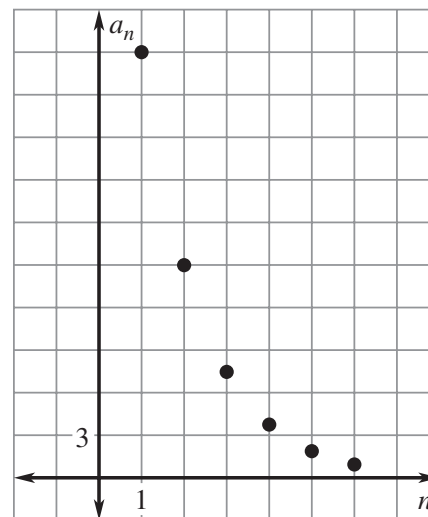
29. $a_n = -2(6)^{n-1}$



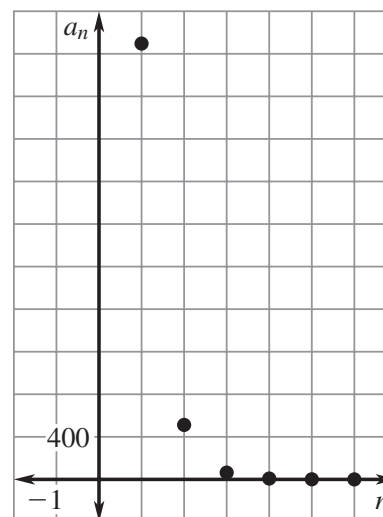
30. $a_n = 3(2)^{n-1}$



31. $a_n = 30\left(\frac{1}{2}\right)^{n-1}$



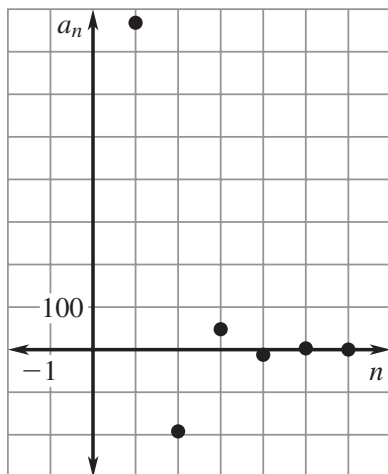
32. $a_n = 4096\left(\frac{1}{8}\right)^{n-1}$



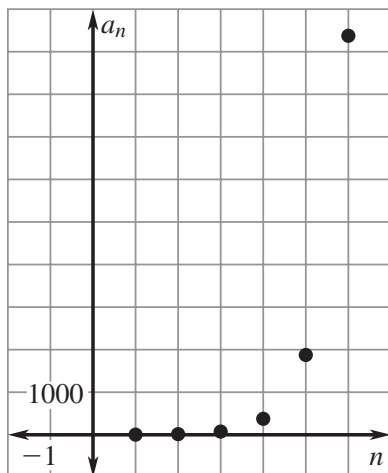
Answers for 12.3 *continued*

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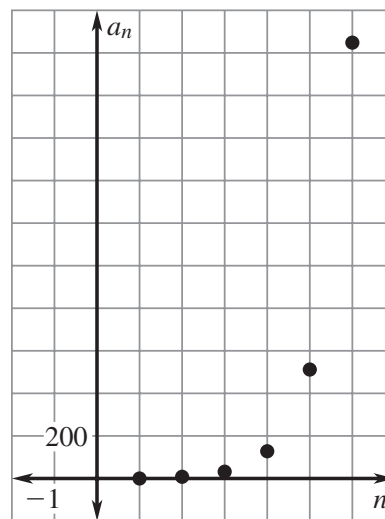
33. $a_n = 768\left(-\frac{1}{4}\right)^{n-1}$



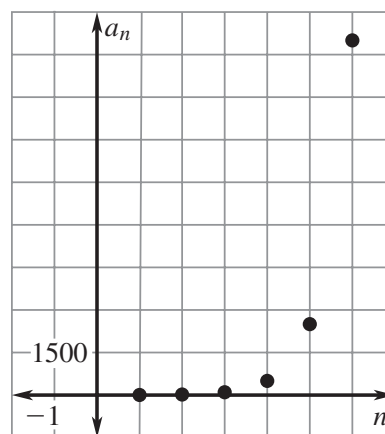
34. $a_n = 3(5)^{n-1}$



35. $a_n = 2(4)^{n-1}$



36. $a_n = 4(5)^{n-1}$



37. The exponent should be $n - 1$ instead of n ; $a_n = 3(2)^{n-1}$.

38. r and a_1 are switched around in the formula; $a_n = a_1 r^{n-1}$,

$$a_n = 3(2)^{n-1}.$$

39. $a_n = 3(2)^{n-1}$

40. $a_n = 1(5)^{n-1}$

41. $a_n = \left(-\frac{1}{4}\right)(4)^{n-1}$

Answers for 12.3 *continued*

For use with pages 814–818

$$42. a_n = \left(\frac{10}{9}\right)(3)^{n-1}$$

$$43. a_n = -80\left(\frac{1}{2}\right)^{n-1}$$

$$44. a_n = 6(-4)^{n-1}$$

$$45. a_n = 6(3)^{n-1}$$

$$46. a_n = 7\left(\frac{1}{2}\right)^{n-1}$$

$$47. a_n = \frac{32}{27}\left(\frac{3\sqrt[3]{12}}{4}\right)^{n-1}$$

$$48. 5115 \qquad 49. 131,070$$

$$50. \frac{255}{32} \qquad 51. \frac{1365}{256}$$

$$52. \frac{527,345}{256} \qquad 53. 838,861$$

54. C

55. *Sample answer:*

$$\frac{100}{31}, \frac{200}{31}, \frac{400}{31}, \frac{800}{31}, \frac{1600}{31}$$

$$56. \text{ a. } S_5 = \left(\frac{1-x^5}{1-x}\right)$$

$$\text{ b. } S_4 = 3x\left(\frac{1-16x^8}{1-2x^2}\right)$$

12.3 Problem Solving

$$57. \text{ a. } a_n = 5(2)^{n-1}$$

b. 75 skydivers

$$58. \text{ a. } a_n = 32\left(\frac{1}{2}\right)^{n-1}; 1 \leq n \leq 6$$

b. 63 games

$$59. \text{ a. } a_n = 1024\left(\frac{1}{2}\right)^{n-1}$$

b. 11. *Sample answer:* On the 11th pass, there is only 1 term to choose from so it must be the answer.

$$60. \text{ a. } a_n = (8)^{n-1};$$

2,396,745 squares

$$\text{ b. } a_n = \frac{8}{9}\left(\frac{8}{9}\right)^{n-1}; \text{ about } 0.2433$$

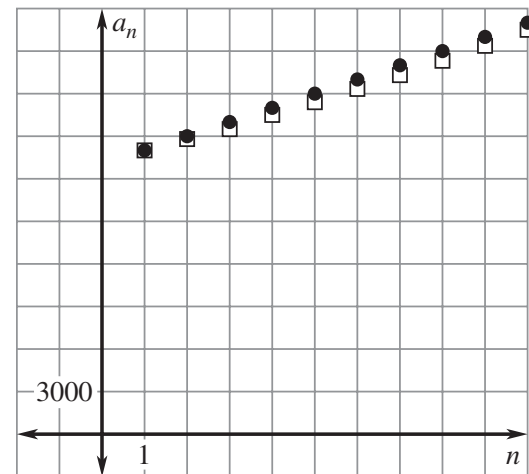
$$61. \text{ a. } a_n = 19,000 + 1000n,$$

arithmetic;

$$b_n = 20,000(1.04)^{n-1},$$

geometric

b.



c. Company A: \$590,000;
Company B: about \$595,562

d. 19 yr

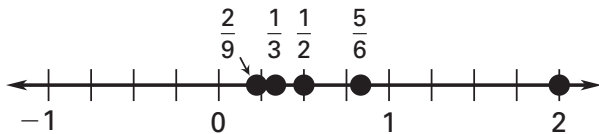
$$62. \$139,521.58$$

Answers for 12.3 *continued*

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12.3 Mixed Review

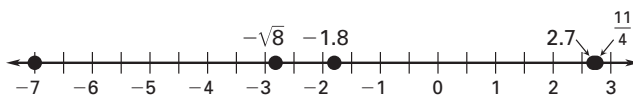
63.



64.



65.



66. $-\frac{5}{9}$

67. $\frac{7}{10}$

68. $\frac{8}{13}$

69. 0, 9

70. -9, -2

71. 16

72. 210

73. 378

74. 9

75. 333

76. -128

77. 1084

12.1–12.3 Mixed Review of Problem Solving

1. a. $a_n = 45,000(1.035)^{n-1}$

b. \$51,638.54

c. \$2,323,020.48

2. a. $a_n = (2n - 1)\pi$

b. $\sum_{i=2}^n (2i - 1)\pi$

c. $\pi, 4\pi, 16\pi$; it quadruples the area.

3. $2 + 4n$; arranging the tables with their short ends together creates room for 4 more chairs with each table that is added, where arranging the tables with their long ends together creates room for 2 more chairs with each table that is added.

4. Sample answer: $\sum_{i=1}^8 \frac{19}{14} + \frac{23}{14}i$

5. 105 pieces of chalk;

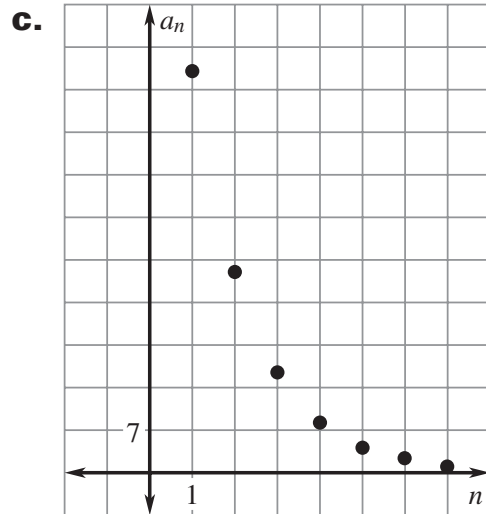
	1	0	5
	/	/	
•	•	•	•
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

6. $a_n = 2 + 7n$; 72 in.; change the formula to be $a_n = 2 + 7(n - 1)$

Answers for 12.3 *continued*
 For use with pages 814–818

7. a. Geometric; there is a constant ratio of $\frac{1}{2}$ between terms.

b. $a_n = 66\left(\frac{1}{2}\right)^{n-1}$



exponential decay

d. 14 h

8. *Sample answer:* 3, 6, 9, 12, 15;

$$\frac{45}{31}, \frac{90}{31}, \frac{180}{31}, \frac{360}{31}, \frac{720}{31}$$