Name _____ Class _____ Date _____

9-1 Practice *Form G*

Mathematical Patterns

Find the first six terms of each sequence.

1. $a_n = -2n + 1$
   −1, −3, −5, −7, −9, −11
2. $a_n = n^2 - 1$
   0, 3, 8, 15, 24, 35
3. $a_n = 2n^2 + 1$
   3, 9, 19, 33, 51, 73
4. $a_n = 1^n + 1$
   2, 2, 2, 2, 2, 2
5. $a_n = 2^n + 2$
   4, 6, 10, 18, 34, 66
6. $a_n = 2n^2 - n$
   1, 6, 15, 28, 45, 66
7. $a_n = 4n + n^2$
   5, 12, 21, 32, 45, 60
8. $a_n = \frac{1}{3}n^3$
   $\frac{1}{3}, \frac{8}{3}$, 9, $\frac{64}{3}, \frac{125}{3}$, 72
9. $a_n = (-2)^n$
   −2, 4, −8, 16, −32, 64

Write a recursive definition for each sequence.

10. $-14, -8, -2, 4, 10, \ldots$
    $a_n = a_{n-1} + 6$ where $a_1 = -14$
11. $6, 5.7, 5.4, 5.1, 4.8, \ldots$
    $a_n = a_{n-1} - 0.3$ where $a_1 = 6$
12. $1, -2, 4, -8, 16, \ldots$
    $a_n = -2a_{n-1}$ where $a_1 = 1$
13. $1, 3, 9, 27, \ldots$
    $a_n = 3a_{n-1}$ where $a_1 = 1$
14. $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$
    $a_n = \frac{1}{2}a_{n-1}$ where $a_1 = 1$
15. $\frac{2}{3}, 1, 1\frac{1}{3}, 1\frac{2}{3}, 2, \ldots$
    $a_n = a_{n-1} + \frac{1}{3}$ where $a_1 = \frac{2}{3}$
16. $36, 39, 42, 45, 48, \ldots$
    $a_n = a_{n-1} + 3$ where $a_1 = 36$
17. $36, 30, 24, 18, 12, \ldots$
    $a_n = a_{n-1} - 6$ where $a_1 = 36$
18. $9.6, 4.8, 2.4, 1.2, 0.6, \ldots$
    $a_n = \frac{1}{2}a_{n-1}$ where $a_1 = 9.6$

Write an explicit formula for each sequence. Find the twentieth term.

19. $7, 14, 21, 28, 35, \ldots$
    $a_n = 7n$; 140
20. $2, 8, 14, 20, 26, \ldots$
    $a_n = 6n - 4$; 116
21. $5, 6, 7, 8, 9, \ldots$
    $a_n = n + 4$; 24
22. $-1, 0, 1, 2, 3, \ldots$
    $a_n = n - 2$; 18
23. $3, 5, 7, 9, 11, \ldots$
    $a_n = 2n + 1$; 41
24. $0.8, 1.6, 2.4, 3.2, 4, \ldots$
    $a_n = 0.8n$; 16
25. $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, \frac{5}{4}, \ldots$
    $a_n = \frac{n}{4}$; 5
26. $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \frac{1}{10}, \ldots$
    $a_n = \frac{1}{2n}$; $\frac{1}{40}$
27. $\frac{2}{3}, 1\frac{2}{3}, 2\frac{2}{3}, 3\frac{2}{3}, 4\frac{2}{3}, \ldots$
    $a_n = n - \frac{1}{3}$; $19\frac{2}{3}$

Find the eighth term of each sequence.

28. $1, 3, 5, 7, 9, \ldots$
    15
29. $400, 200, 100, 50, 25, \ldots$
    3.125
30. $0, -2, -4, -6, -8, \ldots$
    −14
31. $1, 2, 4, 8, 16, \ldots$
    128
32. $44, 39, 34, 29, 24, \ldots$
    9
33. $0.7, 0.8, 0.9, 1.0, 1.1, \ldots$
    1.4
34. $4, 11, 18, 25, 32, \ldots$
    53.
35. $1\frac{1}{4}, 2\frac{1}{2}, 5, 10, 20, \ldots$
    160
36. $-6, -9, -12, -15, -18,$
    −27

37. A man swims 1.5 mi on Monday, 1.6 mi on Tuesday, 1.8 mi on Wednesday, 2.1 mi on Thursday, and 2.5 mi on Friday. If the pattern continues, how many miles will he swim on Saturday? **3.0 mi**

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9-1 Practice (continued) *Form G*

Mathematical Patterns

Determine whether each formula is *explicit* or *recursive*. Then find the first five terms of each sequence.

38. $a_n = \frac{1}{3}n$
explicit; $\frac{1}{3}$, $\frac{2}{3}$, 1, $\frac{4}{3}$, $\frac{5}{3}$

39. $a_n = n^2 - 6$
explicit; −5, −2, 3, 10, 19

40. $a_1 = 5, a_n = 3a_{n-1} - 7$
recursive; 5, 8, 17, 44, 125

41. $a_n = \frac{1}{2}(n - 1)$
explicit; 0, $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2

42. $a_1 = 5, a_n = 3 - a_{n-1}$
recursive; 5, −2, 5, −2, 5

43. $a_1 = -4, a_n = 2a_{n-1}$
recursive; −4, −8, −16, −32, −64

44. Error Analysis Your friend says the explicit formula for the sequence 1, 8, 27, 64 is $a_n = n^2$. Is she correct? Explain. She is incorrect; in order to find each term in the sequence, the term number must be cubed, not squared.

45. Writing Explain how to find an explicit formula for a sequence. Look for a pattern in the sequence and find a mathematical rule that gives the *n*th term, given the number *n*.

46. The first figure of a fractal contains one segment. For each successive figure, six segments replace each segment.
a. How many segments are in each of the first four figures of the sequence? 1, 6, 36, 216
b. Write a recursive definition for the sequence. $a_n = 6a_{n-1}$ where $a_1 = 1$

47. The sum of the measures of the exterior angles of any polygon is 360°. All the angles have the same measure in a regular polygon.
a. Find the measure of one exterior angle in a regular hexagon (six angles). 60°
b. Write an explicit formula for the measure of one exterior angle in a regular polygon with n angles. $a_n = \frac{360}{n}$
c. Why would this formula not be meaningful for $n = 1$ or $n = 2$?
No polygon has one or two angles.

48. Reasoning In order to find a term in a sequence, its position in the sequence is doubled and then two is added. What are the first ten terms in the sequence?
4, 6, 8, 10, 12, 14, 16, 18, 20, 22

49. Writing Explain the difference between a recursive and an explicit formula.
An explicit formula defines how to find the *n*th term directly from the number *n*, while a recursive formula defines how to find each term from the previous term(s).

50. Open-Ended Write five terms in a sequence. Describe the sequence using a recursive or explicit formula. Check students' work.

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9-1 Practice *Form K*

Mathematical Patterns

Find the first five terms of each sequence.

1. $a_n = 4n - 1$

Substitute 1 for n and simplify.

$a_1 = 4(1) - 1 = 3$

Substitute 2 for n and simplify.

$a_2 = 4(2) - 1 = 7$

Continue for the numbers 3, 4, and 5.

The first five terms are 3, 7, [11], [15], and [19].

2. $a_n = n^2 + 4$

5, 8, 13, 20, 29

3. $a = \frac{1}{2}n + 2$

2.5, 3, 3.5, 4, 4.5

4. $a_n = 3^n$

3, 9, 27, 81, 243

5. $a_n = -6n^2$

−6, −24, −54, −96, −150

6. Write an explicit formula for a sequence with 3, 5, 7, 9, and 11 as its first five terms.

$a_n = 2n + 1$

Write a recursive definition for each sequence.

7. 2, 6, 12, 20, . . .

Identify the initial condition.

$a_1 = 2$

Use n to express the relationship between successive terms.

$a_n = a_{n-1} + 2n$

8. 120, 60, 30, 15, . . .

$a_1 = 120; a_n = \left(\frac{1}{2}\right)a_{n-1}$

9. 3, 8, 13, 18, . . .

$a_1 = 3; a_n = a_{n-1} + 5$

10. 1, 3, 9, 27, . . .

$a_1 = 1; a_n = 3a_{n-1}$

11. 2, 3, 8, 63, . . .

$a_1 = 2; a_n = a_{n-1}^2 - 1$

12. Writing Explain the difference between a recursive definition and an explicit formula. An explicit formula describes the nth term of a sequence using the number n. A recursive formula defines a sequence by the relationship between successive terms.

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9-1 Practice (continued) *Form K*

Mathematical Patterns

Write an explicit formula for each sequence. Then find the tenth term.

13. 7, 10, 13, 16, . . .

$a_n = 3n + 4$

$a_{10} = 3(10) + 4 =$ **34**

14. 8, 9, 10, 11, 12, . . .

$a_n = n + 7$; 17

15. $-\frac{1}{2}, 0, \frac{1}{2}, 1, 1\frac{1}{2}, \ldots$

$a_n = \frac{1}{2}n - 1$; 4

16. 1, 4, 9, 16, . . .

$a_n = n^2$; 100

17. 3, 1, −1, −3, −5, . . .

$a_n = -2n + 5$; −15

18. 1, 7, 25, 79, 241

$a_n = 3^n - 2$; 59,047

19. Reasoning You and your friend are trying to find the 80th term in the sequence 8, 14, 20, 26, 32, ... You use a recursive definition and your friend uses an explicit formula. Who will find the 80th term first? Why?

Your friend will find the 80th term first because he is using an explicit formula. Your friend will substitute 80 into the formula to get the answer, while you will go through 79 iterations of the recursive formula.

20. Your neighbor recently began learning to play the guitar. On the first day, she practiced for 0.4 h. On the second day, she practiced for 0.5 h. She practiced for 0.65 h on the third day, and 0.85 h on the fourth day. If this pattern continues, how long will she practice on the seventh day? **1.75 h**

21. Charles lost two rented movies, so he owes the rental store a fee of $40. At the end of each month, the amount that Charles owes will increase by 5%, plus a $2 billing fee. How much money will Charles owe the rental store after 8 months? **$78.20**