Write the first six terms of the sequence.

1. $a_n = 4 - \frac{1}{2}n$
2. $f(n) = \frac{3n+1}{n}$
3. $a_n = n^2 + n$
4. $f(n) = 2\left(\frac{3}{2}\right)^{n-1}$
5. $a_n = n^3 - 10$
6. $a_1 = 1,\ a_n = a_{n-1} + 3$

Warm Up

Solve the quadratic equation.

1. $3x^2 - 2x - 2 = 0$
2. $-x^2 + 3x = -5x + 2$
3. $5 - 2x = x^2 - 5x + 7$
4. $7x^2 + 3 = x^2 + 15$
5. $\frac{1}{2}x^2 - 5x + 3 = 0$
6. $\frac{2}{3} - \frac{1}{2}x^2 = -\frac{1}{3}x - 2$

Cumulative Warm Up

Essential Question

How can you define a sequence recursively?

Essential Question

Work with a partner. Use each recursive rule and a spreadsheet to write the first six terms of the sequence. Classify the sequence as arithmetic, geometric, or neither. Explain your reasoning. (The figure shows a partially completed spreadsheet for part (a).)

a. $a_1 = 7$, $a_n = a_{n-1} + 3$

	A	B
1	n	nth Term
2	1	7
3	2	10
4	3	
5	4	
6	5	
7	6	

B2+3

b. $a_1 = 5$, $a_n = a_{n-1} - 2$

c. $a_1 = 1$, $a_n = 2a_{n-1}$

d. $a_1 = 1$, $a_n = \frac{1}{2}(a_{n-1})^2$

Exploration 1 a-d

e. $a_1 = 3$, $a_n = a_{n-1} + 1$

f. $a_1 = 4$, $a_n = \frac{1}{2}a_{n-1} - 1$

g. $a_1 = 4$, $a_n = \frac{1}{2}a_{n-1}$

h. $a_1 = 4$, $a_2 = 5$, $a_n = a_{n-1} + a_{n-2}$

Exploration 1 e-h

Work with a partner. Write a recursive rule for the sequence. Explain your reasoning.

a. 3, 6, 9, 12, 15, 18, . . .

b. 18, 14, 10, 6, 2, −2, . . .

c. 3, 6, 12, 24, 48, 96, . . .

d. 128, 64, 32, 16, 8, 4, . . .

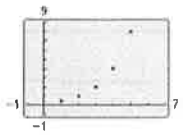
e. 5, 5, 5, 5, 5, 5, . . .

f. 1, 1, 2, 3, 5, 8, . . .

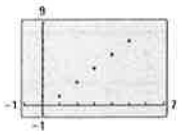
Exploration 2

Work with a partner. Write a recursive rule for the sequence whose graph is shown.

a.



b.



Exploration 3

Write the first six terms of each sequence.

a. $a_0 = 1$, $a_n = a_{n-1} + 4$

b. $f(1) = 1$, $f(n) = 3 \cdot f(n - 1)$

Example 1

Write the first six terms of the sequence.

1. $a_1 = 3$, $a_n = a_{n-1} - 7$

2. $a_0 = 162$, $a_n = 0.5a_{n-1}$

3. $f(0) = 1$, $f(n) = f(n - 1) + n$

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

Monitoring Progress 1-4

Core Concept

Recursive Equations for Arithmetic and Geometric Sequences

Arithmetic Sequence

$a_n = a_{n-1} + d$, where d is the common difference

Geometric Sequence

$a_n = r \cdot a_{n-1}$, where r is the common ratio

Core Concept

Write a recursive rule for (a) 3, 13, 23, 33, 43, . . . and (b) 16, 40, 100, 250, 625, ...

Example 2

Write a recursive rule for each sequence.

a. 1, 1, 2, 3, 5, . . . **b.** 1, 1, 2, 6, 24, . . .

Example 3

Write a recursive rule for the sequence.

5. 2, 14, 98, 686, 4802, . . .

6. 19, 13, 7, 1, −5, . . .

7. 11, 22, 33, 44, 55, . . .

8. 1, 2, 2, 4, 8, 32, . . .

Monitoring Progress 5-8

Write a recursive rule for (a) $a_n = -6 + 8n$ and (b) $a_n = -3\left(\frac{1}{2}\right)^{n-1}$.

Example 4

Write an explicit rule for each sequence.

a. $a_1 = -5$, $a_n = a_{n-1} - 2$

b. $a_1 = 10$, $a_n = 2a_{n-1}$

Example 5

Write a recursive rule for the sequence.

9. $a_n = 17 - 4n$ **10.** $a_n = 16(3)^{n-1}$

Write an explicit rule for the sequence.

11. $a_1 = -12$, $a_n = a_{n-1} + 16$ **12.** $a_1 = 2$, $a_n = -6a_{n-1}$

Monitoring Progress 9-12

A lake initially contains 5200 fish. Each year, the population declines 30% due to fishing and other causes, so the lake is restocked with 400 fish.

a. Write a recursive rule for the number a_n of fish at the start of the nth year.

b. Find the number of fish at the start of the fifth year.

c. Describe what happens to the population of fish over time.

Example 6

13. WHAT IF? In Example 6, suppose 75% of the fish remain each year. What happens to the population of fish over time?

Monitoring Progress 13

You borrow $150,000 at 6% annual interest compounded monthly for 30 years. The monthly payment is $899.33.

- Find the balance after the third payment.
- Due to rounding in the calculations, the last payment is often different from the original payment. Find the amount of the last payment.

Example 7

14. WHAT IF? How do the answers in Example 7 change when the annual interest rate is 7.5% and the monthly payment is $1048.82?

Monitoring Progress 14

3-2-1: Hand out a *3-2-1* reflection sheet as described in the *Formative Assessment Tips* on page T-274.

Closure