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# 8.5 Using Recursive Rules with Sequences

**For use with Exploration 8.5**

**Essential Question** How can you define a sequence recursively?

A **recursive rule** gives the beginning term(s) of a sequence and a *recursive equation* that tells how $a_n$ is related to one or more preceding terms.

## 1 EXPLORATION: Evaluating a Recursive Rule

**Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.**

**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 | B |
|---|---|---|
| 1 | n | nth Term |
| 2 | 1 | 7 |
| 3 | 2 | 10 |
| 4 | 3 | |
| 5 | 4 | |
| 6 | 5 | |
| 7 | 6 | |

B2+3

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

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

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

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

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

## 8.5 Using Recursive Rules with Sequences (continued)

### 2 EXPLORATION: Writing a Recursive Rule

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

**a.** $3, 6, 9, 12, 15, 18, \ldots$

**b.** $18, 14, 10, 6, 2, -2, \ldots$

**c.** $3, 6, 12, 24, 48, 96, \ldots$

**d.** $128, 64, 32, 16, 8, 4, \ldots$

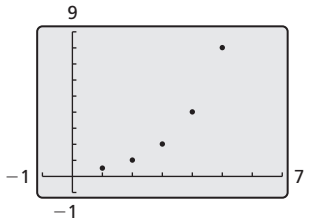
**e.** $5, 5, 5, 5, 5, 5, \ldots$

**f.** $1, 1, 2, 3, 5, 8, \ldots$

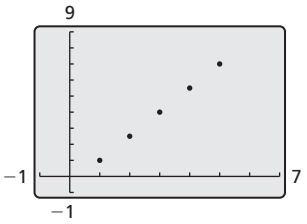
### 3 EXPLORATION: Writing a Recursive Rule

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

**a.**



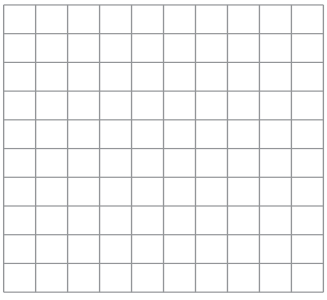

**b.**




## Communicate Your Answer

**4.** How can you define a sequence recursively?

**5.** Write a recursive rule that is different from those in Explorations 1–3. Write the first six terms of the sequence. Then graph the sequence and classify it as arithmetic, geometric, or neither.



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# 8.5 Notetaking with Vocabulary

**For use after Lesson 8.5**

**In your own words, write the meaning of each vocabulary term.**

explicit rule

recursive rule

## Core Concepts

### 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

### Notes:

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## 8.5 Notetaking with Vocabulary (continued)

## Extra Practice

**In Exercises 1 and 2, write the first six terms of the sequence.**

**1.** $a_1 = 2$

$a_n = a_{n-1} + 5$

**2.** $f(0) = 1$

$f(n) = 2f(n-1)$

**In Exercises 3–6, write a recursive rule for the sequence.**

**3.** $9, 12, 15, 18, 21, \ldots$

**4.** $50, 20, 8, \frac{16}{5}, \frac{32}{25}, \ldots$

**5.** $3, 4, 1, -3, -4, \ldots$

**6.** $1, 1, \frac{1}{3}, \frac{1}{4}, \frac{1}{15}, \ldots$

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## 8.5 Notetaking with Vocabulary (continued)

**In Exercises 7–10, write a recursive rule for the sequence.**

**7.** $a_n = 5 - 3n$

**8.** $a_n = 10(-2)^{n-1}$

**9.** $a_n = -1 + 8n$

**10.** $a_n = -3\left(\frac{3}{4}\right)^{n-1}$

**In Exercises 11–14, write an explicit rule for each sequence.**

**11.** $a_1 = -1, a_n = a_{n-1} + 7$

**12.** $a_1 = 24, a_n = 0.2a_{n-1}$

**13.** $a_1 = 1, a_n = a_{n-1} - 0.3$

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