Name ____ Date __________

8.1 Defining and Using Sequences and Series

For use with Exploration 8.1

Essential Question How can you write a rule for the *n*th term of a sequence?

A **sequence** is an ordered list of numbers. There can be a limited number or an infinite number of *terms* of a sequence.

$a_1, a_2, a_3, a_4, ..., a_n, \ldots$ Terms of a sequence

Here is an example.

$1, 4, 7, 10, ..., 3n - 2, \ldots$

1 EXPLORATION: Writing Rules for Sequences

Work with a partner. Match each sequence with its graph on the next page. The horizontal axes represent n, the position of each term in the sequence. Then write a rule for the nth term of the sequence, and use the rule to find a_{10}.

a. $1, 2.5, 4, 5.5, 7, \ldots$

b. $8, 6.5, 5, 3.5, 2, \ldots$

c. $\frac{1}{4}, \frac{4}{4}, \frac{9}{4}, \frac{16}{4}, \frac{25}{4}, \ldots$

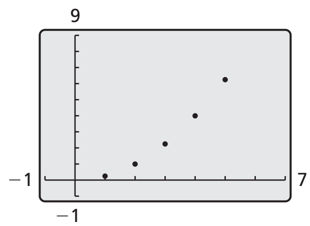
d. $\frac{25}{4}, \frac{16}{4}, \frac{9}{4}, \frac{4}{4}, \frac{1}{4}, \ldots$

e. $\frac{1}{2}, 1, 2, 4, 8, \ldots$

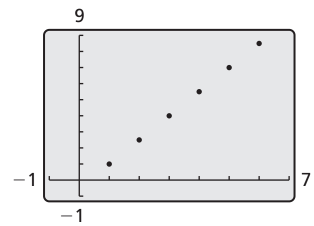
f. $8, 4, 2, 1, \frac{1}{2}, \ldots$

1 EXPLORATION: Writing Rules for Sequences (continued)

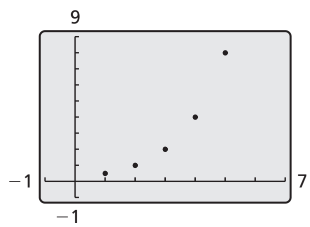
A.



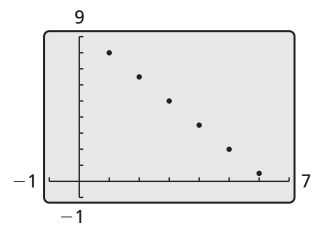
B.



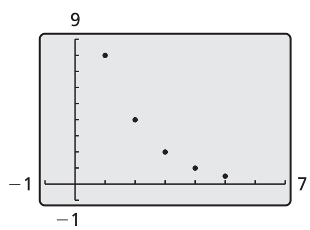
C.



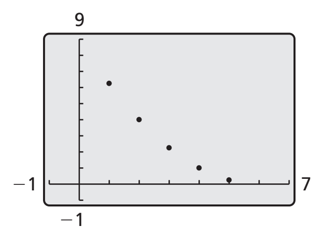
D.



E.



F.



Communicate Your Answer

2. How can you write a rule for the *n*th term of a sequence?

3. What do you notice about the relationship between the terms in (a) an arithmetic sequence and (b) a geometric sequence? Justify your answers.

Name ______________________________ Date __________

8.1 Notetaking with Vocabulary

For use after Lesson 8.1

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

sequence

terms of a sequence

series

summation notation

sigma notation

Core Concepts

Sequences

A **sequence** is an ordered list of numbers. A *finite sequence* is a function that has a limited number of terms and whose domain is the finite set $\{1, 2, 3, \ldots, n\}$. The values in the range are called the **terms** of the sequence.

Domain:	1	2	3	4	. . .	n	Relative position of each term
	↓	↓	↓	↓		↓	
Range:	a_1	a_2	a_3	a_4	. . .	a_n	Terms of the sequence

An *infinite sequence* is a function that continues without stopping and whose domain is the set of positive integers. Here are examples of a finite sequence and an infinite sequence.

Finite sequence: 2, 4, 6, 8 **Infinite sequence:** 2, 4, 6, 8, …

A sequence can be specified by an equation, or *rule*. For example, both sequences above can be described by the rule $a_n = 2n$ or $f(n) = 2n$.

Notes:

8.1 Notetaking with Vocabulary (continued)

Series and Summation Notation

When the terms of a sequence are added together, the resulting expression is a **series**. A series can be finite or infinite.

Finite series: $2 + 4 + 6 + 8$

Infinite series: $2 + 4 + 6 + 8 + \cdots$

You can use **summation notation** to write a series. For example, the two series above can be written in summation notation as follows:

Finite series: $2 + 4 + 6 + 8 = \sum_{i=1}^{4} 2i$

Infinite series: $2 + 4 + 6 + 8 + \cdots = \sum_{i=1}^{\infty} 2i$

For both series, the *index of summation* is i and the *lower limit of summation* is 1. The *upper limit of summation* is 4 for the finite series and ∞ (infinity) for the infinite series. Summation notation is also called **sigma notation** because it uses the uppercase Greek letter *sigma*, written $\sum$.

Notes:

Formulas for Special Series

Sum of *n* terms of 1: $\sum_{i=1}^{n} 1 = n$

Sum of first *n* positive integers: $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$

Sum of squares of first *n* positive integers: $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$

Notes:

Extra Practice

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

1. $a_n = n^3 - 1$

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

In Exercises 3 and 4, describe the pattern, write the next term, and write a rule for the *n*th term of the sequence.

3. $-3, -1, 1, 3, \ldots$

4. $\frac{2}{5}, \frac{4}{5}, \frac{6}{5}, \frac{8}{5}, \ldots$

5. Write the series $-1 + 4 - 9 + 16 - 25 + \cdots$ using summation notation.

In Exercises 6 and 7, find the sum.

6. $\sum_{n=2}^{5} \frac{n}{n-1}$

7. $\sum_{i=1}^{18} i^2$