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6.7 Geometric Sequences

For use with Exploration 6.7

Essential Question How can you use a geometric sequence to describe a pattern?

In a **geometric sequence**, the ratio between each pair of consecutive terms is the same. This ratio is called the **common ratio**.

1 EXPLORATION: Describing Calculator Patterns

Work with a partner. Enter the keystrokes on a calculator and record the results in the table. Describe the pattern.

a. **Step 1** 2 =
Step 2 × 2 =
Step 3 × 2 =
Step 4 × 2 =
Step 5 × 2 =

Step	1	2	3	4	5
Calculator display					

b. **Step 1** 6 4 =
Step 2 × . 5 =
Step 3 × . 5 =
Step 4 × . 5 =
Step 5 × . 5 =

Step	1	2	3	4	5
Calculator display					

c. Use a calculator to make your own sequence. Start with any number and multiply by 3 each time. Record your results in the table.

Step	1	2	3	4	5
Calculator display					

d. Part (a) involves a geometric sequence with a common ratio of 2. What is the common ratio in part (b)? part (c)?

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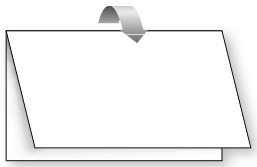
6.7 Geometric Sequences (continued)

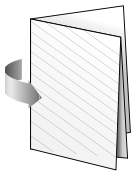
2 EXPLORATION: Folding a Sheet of Paper

Work with a partner. A sheet of paper is about 0.1 millimeter thick.

a. How thick will it be when you fold it in half once? twice? three times?



b. What is the greatest number of times you can fold a piece of paper in half? How thick is the result?



c. Do you agree with the statement below? Explain your reasoning.

"*If it were possible to fold the paper in half 15 times, it would be taller than you*."

Communicate Your Answer

3. How can you use a geometric sequence to describe a pattern?

4. Give an example of a geometric sequence from real life other than paper folding.

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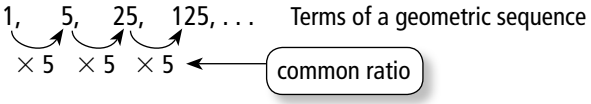
6.7 Practice
For use after Lesson 6.7

Core Concepts

Geometric Sequence

In a **geometric sequence**, the ratio between each pair of consecutive terms is the same. This ratio is called the **common ratio**. Each term is found by multiplying the previous term by the common ratio.



Notes:

Equation for a Geometric Sequence

Let a_n be the nth term of a geometric sequence with first term a_1 and common ratio r. The nth term is given by

$$a_n = a_1 r^{n-1}.$$

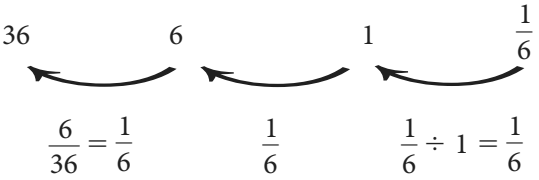
Notes:

Worked-Out Examples

Example #1

Find the common ratio of the geometric sequence.

$36, 6, 1, \frac{1}{6}, \ldots$



The common ratio is $\frac{1}{6}$.

Example #2

Write an equation for the *n*th term of the geometric sequence. Then find a_6.

$2, 8, 32, 128, \ldots$

$a_1 = 2, r = \frac{8}{2} = 4$
$a_n = a_1 r^{n-1}$
$a_n = 2(4)^{n-1}$

$a_n = 2(4)^{n-1}$
$a_6 = 2(4)^{6-1}$
$= 2(4)^5$
$= 2(1024)$
$= 2048$

The 6th term of the geometric sequence is 2048.

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6.7 Practice (continued)

Practice A

In Exercises 1–6, determine whether the sequence is *arithmetic*, *geometric*, or *neither*. Explain your reasoning.

1. $1, -4, 16, -64, \ldots$

2. $3, 7, 11, 15, \ldots$

3. $2, 4, 8, 32, \ldots$

4. $12, 9, 7, 5, \ldots$

5. $6, 18, 54, 162, \ldots$

6. $11, 19, 27, 35, \ldots$

In Exercises 7–9, write the next three terms of the geometric sequence.

7. $7, 21, 63, 189, \ldots$

8. $576, 288, 144, 72, \ldots$

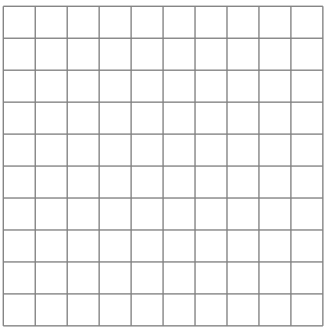
9. $5, -10, 20, -40, \ldots$

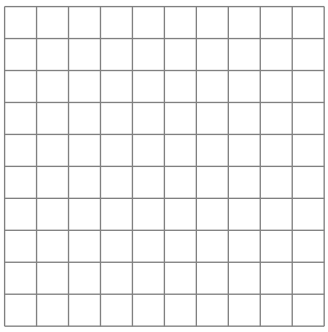
In Exercises 10–12, write the next three terms of the geometric sequence. Then graph the sequence.

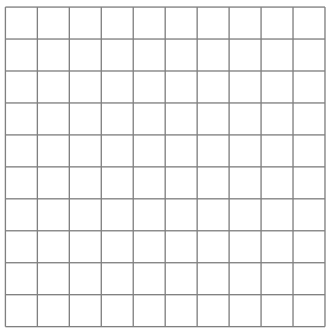
10. $12, 6, 3, \frac{3}{2}, \ldots$

11. $3, 12, 48, 192, \ldots$

12. $0.008, 0.04, 0.2, 1, \ldots$







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6.7 Practice (continued)

In Exercises 13–20, write an equation for the *n*th term of the geometric sequence. Then find a_6.

13. 6561, 2187, 729, 243, …

14. 8, −24, 72, −216, …

15. 3, 15, 75, 375, …

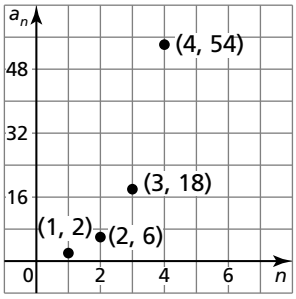
16.

n	1	2	3	4
a_n	2916	972	324	108

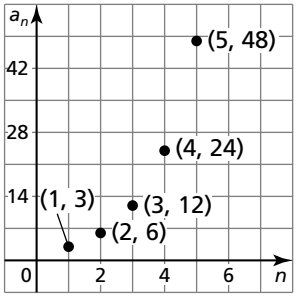
17.

n	1	2	3	4
a_n	11	44	176	704

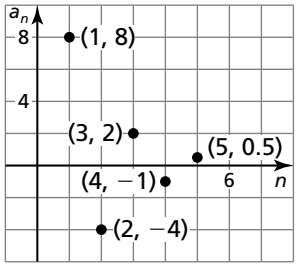
18.



19.



20.



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Practice B

In Exercises 1–3, find the common ratio of the geometric sequence.

1. 5, 20, 80, 320, …

2. 144, −72, 36, −18, …

3. 24, 84, 294, 1029, …

In Exercises 4–7, determine whether the sequence is *arithmetic*, *geometric*, or *neither*. Explain your reasoning.

4. 2.786, 27.86, 278.6, 2786, …

5. 86, 71, 56, 41, …

6. 4, −10, 16, −28, …

7. 112, −28, 7, $-\frac{7}{4}$, …

In Exercises 8 and 9, write the next three terms of the geometric sequence. Then graph the sequence.

8. −2, −12, −72, −432, …

9. $\frac{54}{25}$, $\frac{18}{5}$, 6, 10, …

In Exercises 10–13, write an equation for the *n*th term of the geometric sequence. Then find a_6.

10. $\frac{3}{125}$, $\frac{3}{25}$, $\frac{3}{5}$, 3, …

11. 0.2, 1.6, 12.8, 102.4, …

12.

n	1	2	3	4
a_n	2436	−243.6	24.36	−2.436

13.

n	1	2	3	4
a_n	−1458	−162	−18	−2

14. An archery competition begins with 256 competitors. After the first round, one-fourth of the competing group remains. After the second round, one-fourth of the now smaller competing group remains. The last round is when there are fewer than five members in the competing group.

a. Which round is the last round?

b. How many competitors are in the last round?

15. What is the 10th term of the geometric sequence where $a_3 = \frac{8}{3}$ and $r = \frac{2}{3}$?

16. Find the sum of the terms of the geometric sequence

$$1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots.$$

Explain your reasoning.