Brockton High School
Content: Math I
Week of: May 11 to May 15, 2020

Greetings Math I Students! We hope you are safe and well with your families! This assignment is for this week, use your time wisely. You do not have to complete this in one sitting. Here is the lesson plan for this week:

Goals For This Week
Learning Objectives: Students will be able to: 1. Determine the next term in the sequence. 2. Recognize arithmetic sequences and geometric sequences. 3. Determine the common difference or common ratio for a sequence. 4. Graph arithmetic and geometric sequences. 5. Recognize graphically behavior of sequences. 6. Sort sequences that are represented graphically. *(Standard F.BF.2)*
Literacy Objectives: Students will be able to: 1. to compute, interpret and explain numbers. 2. to read, break down, and solve a word problem. 3. To identify a pattern, explain a pattern, and/or make a prediction based on a pattern. *(https://www.bpsma.org/schools/brockton-high-school/about-us/mission-literacy-charts)*
Standards for Mathematical Practice: Students should always look to develop the following habits of mind when working on mathematics: • Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. • Model with mathematics. • Use appropriate tools strategically. • Attend to precision. • Look for and make use of structure. • Look for and express regularity in repeated reasoning.

Carnegie Learning (use with Carnegie Resources provided below)
(Log-in through Clever – see below)

Instructional Video Links: Please watch at least one of these videos to help guide you.

- Video 1: Intro to Arithmetic Sequences
- Video 2: Intro to Geometric Sequences

Printable Resources:
Please see the attached lesson document "The Password Is: Operations – Arithmetic and Geometric Sequences"
(starting on page M1-99)

Practice Activities:
On-Line:
All students now have access to an on-line learning program called Mathia!

- If you are new to Mathia: Please see the log-in information below
- If you are able to get online, please complete
  - IM 1 Mod 1: Getting Started
  - IM 1 Mod. 2: Searching for Patterns

No Internet Access:
Please see information on printable resources.

Key Terms:

- **arithmetic sequence** - a sequence of numbers in which the difference between any two consecutive terms is a constant.
- **common difference** – the common difference is the positive or negative constant added to each term in an arithmetic sequence to produce the next term.
- **geometric sequence** - a sequence of numbers in which the ratio between any two consecutive terms is a constant.
- **common ratio** – the common ratio of a geometric sequence is the non-zero constant by which each term is multiplied to produce the next term.

Extension Activities:
See *Stretch* on page 11 of the document (M1-129).

Log-in Information

1. Log-in to Clever
2. Under Math, click on the Carnegie Learning logo
3. Username: 6-digit BHS school ID # @bpsma.org
   Password: Date of birth bps 1920
   Example: Student (Michael) with ID #:123456
   Date of birth: January 1st, 2000
   Username: 123456@bpsma.org
   Password: 01012000bps1920

Additional Support

Email:

Please email your math teacher with specific questions.

Office Hours:

For a list of office hours for all BHS Math teachers, please click here.

Your teacher is available to help you during their scheduled office hours.

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The Password Is: Operations

Arithmetic and Geometric Sequences

Warm Up

Write the next three terms in each sequence and explain how you generated each term.

1. −2, 4, −8, 16, . . .

2. 60, 53, 46, 39, 32, . . .

3. 1, 5, 17, 53, 161, 485, . . .

4. 4, 10, 16, 22, . . .

Learning Goals

- Determine the next term in a sequence.
- Recognize arithmetic sequences and geometric sequences.
- Determine the common difference or common ratio for a sequence.
- Graph arithmetic and geometric sequences.
- Recognize graphical behavior of sequences.
- Sort sequences that are represented graphically.

Key Terms

- arithmetic sequence
- common difference
- geometric sequence
- common ratio

You have represented patterns as sequences of numbers—a relationship between term numbers and term values. What patterns appear when sequences are represented as graphs?

What Comes Next, and How Do You Know?

Cut out Sequences A through P located at the end of the lesson.

1. **Determine the unknown terms of each sequence. Then describe the pattern under each sequence.**

2. **Sort the sequences into groups based on common characteristics. In the space provided, record the following information for each of your groups.**

   - **List the letters of the sequences in each group.**
   - **Provide a rationale as to why you created each group.**

3. **What mathematical operation(s) did you perform in order to determine the next terms of each sequence?**

ACTIVITY
2.1

Defining Arithmetic and Geometric Sequences

For some sequences, you can describe the pattern as adding a constant to each term to determine the next term. For other sequences, you can describe the pattern as multiplying each term by a constant to determine the next term. Still other sequences cannot be described either way.

An **arithmetic sequence** is a sequence of numbers in which the difference between any two consecutive terms is a constant. In other words, it is a sequence of numbers in which a constant is added to each term to produce the next term. This constant is called the **common difference**. The common difference is typically represented by the variable *d*.

The common difference of a sequence is positive if the same positive number is added to each term to produce the next term. The common difference of a sequence is negative if the same negative number is added to each term to produce the next term.

Remember:

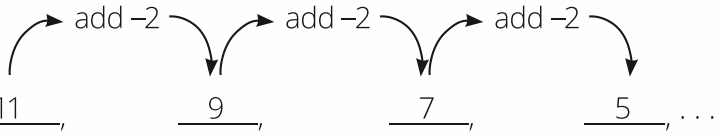
When you add a negative number, it is the same as subtracting a positive number.

Worked Example

Consider the sequence shown.

11, 9, 7, 5, . . .

The pattern is to add the same negative number, −2, to each term to determine the next term.



This sequence is arithmetic and the common difference *d* is −2.

NOTES

1. **Suppose a sequence has the same starting number as the sequence in the worked example, but its common difference is 4.**

   a. **How would the pattern change?**

   b. **Is the sequence still arithmetic? Why or why not?**

   c. **If possible, write the first 5 terms of the new sequence.**

2. **Analyze the sequences you cut out in the Getting Started.**

   a. **List the sequences that are arithmetic.**

   b. **Write the common difference of each arithmetic sequence you identified.**

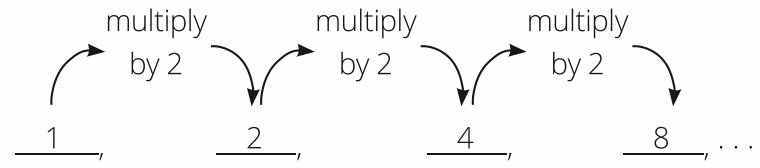
A **geometric sequence** is a sequence of numbers in which the ratio between any two consecutive terms is a constant. In other words, it is a sequence of numbers in which you multiply each term by a constant to determine the next term. This integer or fraction constant is called the common ratio. The **common ratio** is represented by the variable *r*.

Worked Example

Consider the sequence shown.

1, 2, 4, 8, . . .

The pattern is to multiply each term by the same number, 2, to determine the next term.



This sequence is geometric and the common ratio *r* is 2.

3. Suppose a sequence has the same starting number as the sequence in the worked example, but its common ratio is 3.

a. How would the pattern change?

b. Is the sequence still geometric? Explain your reasoning.

c. Write the first 5 terms of the new sequence.

NOTES

4. **Suppose a sequence has the same starting number as the sequence in the worked example, but its common ratio is $\frac{1}{3}$.**

   a. **How would the pattern change?**

   b. **Is the sequence still geometric? Why or why not?**

   c. **Write the first 6 terms of the new sequence.**

5. **Suppose a sequence has the same starting number as the sequence in the worked example, but its common ratio is −2.**

   a. **How would the pattern change?**

   b. **Is the sequence still geometric? Explain your reasoning.**

   c. **Write the first 6 terms of the new sequence.**

6. **Consider the sequence shown.**

   270, 90, 30, 10, . . .

   Devon says that he can determine each term of this sequence by multiplying each term by $\frac{1}{3}$, so the common ratio is $\frac{1}{3}$. Chase says that he can determine each term of this sequence by dividing each term by 3, so the common ratio is 3. Who is correct? Explain your reasoning.

7. **Consider the sequences you cut out in the Getting Started. List the sequences that are geometric. Then write the common ratio on each Sequence Card.**

8. **Consider the sequences that are neither arithmetic nor geometric. List these sequences. Explain why these sequences are neither arithmetic nor geometric.**

9. **Consider the first two terms of the sequence 3, 6, . . .**

   Dante says, "This is how I wrote the sequence for the given terms."

   3, 6, 9, 12, . . .

   Kira says, "This is the sequence I wrote."

   3, 6, 12, 24, . . .

   Who is correct? Explain your reasoning.

10. **Using the terms given in Question 9, write a sequence that is neither arithmetic nor geometric. Then, have your partner tell you what the pattern is in your sequence.**

11. **How many terms did your partner need before the pattern was recognized?**

12. **Consider the sequence 2, 2, 2, 2, 2. . . Identify the type of sequence it is and describe the pattern.**

13. **Begin to complete the graphic organizers located at the end of the lesson to identify arithmetic and geometric sequences. Glue each arithmetic sequence and each geometric sequence to a separate graphic organizer according to its type. Discard all other sequences.**

ACTIVITY
2.2
Matching Graphs and Sequences

As you have already discovered when studying functions, graphs can help you see trends of a sequence—and at times can help you predict the next term in a sequence.

1. **The graphs representing the arithmetic and geometric sequences from the previous activity are located at the end of this lesson. Cut out these graphs. Match each graph to its appropriate sequence and glue it into the Graph section of its graphic organizer.**

2. **What strategies did you use to match the graphs to their corresponding sequences?**

3. **How can you use the graphs to verify that all sequences are functions?**

NOTES

TALK the TALK

Name That Sequence!

Write the first five terms of each sequence described and identify the sequence as arithmetic or geometric.

1. **The first term of the sequence is 8 and the common difference is 12.**

2. **The first term of the sequence is −9 and the common ratio is −2.**

3. **The first term of the sequence is 0 and the common difference is −6.**

4. **The first term of the sequence is −3 and the common ratio is $-\frac{1}{4}$.**

Assignment

Write

Complete each sentence.

1. A sequence which terminates is called a(n) _____ .
2. A(n) _____ is an individual number, figure, or letter in a sequence.
3. A(n) _____ is a pattern involving an ordered arrangement of numbers, geometric figures, letters, or other objects.
4. A sequence which continues forever is called a(n) _____ .

Remember

An arithmetic sequence is a sequence of numbers in which the difference between any two consecutive terms is a constant.

A geometric sequence is a sequence of numbers in which the ratio between any two consecutive terms is a constant.

Practice

Consider the first 2 terms of the sequence 28, 14, . . .

1. Determine whether the sequence is arithmetic or geometric. Explain your reasoning.
2. Suppose the sequence 28, 14, . . . is arithmetic.
   a. Determine the common difference.
   b. List the next 3 terms in the sequence. Explain your reasoning.
   c. Determine whether the sequence is finite or infinite. Explain your reasoning.
3. Suppose the sequence 28, 14, . . . is geometric.
   a. Determine the common ratio.
   b. List the next 3 terms in the sequence. Explain your reasoning.
   c. Determine whether the sequence is finite or infinite. Explain your reasoning.
4. Using the first two terms 28 and 14, write the next 3 terms of a sequence that is neither arithmetic nor geometric.

Stretch

Consider the first 2 terms of the sequence -6, 18, . . .

1. Determine the next 5 terms in the sequence if the sequence is arithmetic. Then write a function to represent the arithmetic sequence.
2. Determine the next 5 terms in the sequence if the sequence is geometric. Then write a function to represent the geometric sequence.

Review

1. Juan updates his blog regularly with trivia questions for readers to answer. The month he started this, there were 8 trivia questions on his blog. The next month, there were 19 trivia questions on his blog. The month after that, there were 30 trivia questions on his blog.
   a. Think about the number of trivia questions on Juan's blog each month. Describe the pattern.
   b. Determine how many trivia questions will be on Juan's blog during months 4, 5, and 6.
   c. Represent the number of trivia questions on Juan's blog for the first 6 months as a numeric sequence. Then represent the sequence using a table of values.

2. Contestants on a popular game show have an opportunity to randomly select a cash prize in 6 hidden containers. The highest possible cash prize is $25,000. The next highest prize is $5000, and the one after that is $1000.
   a. Think about how the value of the prize changes from one container to the next. Describe the pattern.
   b. Determine the prize values in the remaining containers.
   c. Represent the prize values in all six containers as a numeric sequence. Then represent the sequence using a table of values.

3. Enter each function into your graphing calculator to determine the shape of its graph. Then complete the table based on the characteristics of the function family.

Function	Function Family	Increasing/ Decreasing	Absolute Maximum/ Minimum	Curve/ Line
$h(x) = 5 \cdot 2^x$				
$g(x) = 30x - 550$				