

WAMC Lab Template

Math Concept(s): Arithmetic Sequences

Source / Text: Math Medic, Unit 1 Day 3 – Haruko’s Hexagons

Developed by: Angela Frye E-Mail: afrye@freemansd.org

Date: 6/21/2022

Attach the following documents:

- Lab Instructions – see page 4
- Student Handout(s) – N/A
- Rubric and/or Assessment Tool – N/A

Short Description (Be sure to include where in your instruction this lab takes place):

This lab will be a discovery investigation into arithmetic sequences and how to write an equation representing the pattern.

Lab Plan

Lab Title: Haruko’s Hexagons

Prerequisite skills: Students need to know the definition of a hexagon and how to make one.

Lab objectives: Students will be able to:

- Recognize scenarios with a common difference between terms as arithmetic sequences.
- Describe arithmetic sequences with pictures, tables, words, and graphs.

Standards: (Note SPECIFIC relationship to Science, Technology, and/or Engineering)

Mathematics K–12 Learning Standards:

- A-CED.1 – Create equations and inequalities in one variable and use them to solve problems.
- F-BF.1.a – Determine an explicit expression, a recursive process, or steps for calculation from a context.
- F-BF.2 – Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Standards for Mathematical Practice:

- MP1 - Make sense of problems and persevere in solving them.
- MP2 - Reason abstractly and quantitatively.
- MP4 - Model with mathematics.
- MP7 - Look for and make use of structure.
- MP8 - Look for and express regularity in repeated reasoning.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- ELA-Literacy.SL.9-10.1 – Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

- ELA-Literacy.SL.9-10.4 – Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

K-12 Science Standards

- SEP 5 – Use mathematical, computation, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.

Technology

- 5.a – Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
- 5.c – Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

Engineering

- N/A

Leadership/21st Century Skills:

<u>21st Century Interdisciplinary themes</u> (Check those that apply to the above activity.)			
<input type="checkbox"/> Global Awareness	<input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy	<input type="checkbox"/> Civic Literacy	
<input type="checkbox"/> Health/Safety Literacy	<input type="checkbox"/> Environmental Literacy		
<u>21st Century Skills</u> (Check those that students will demonstrate in the above activity.)			
LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
<u>Creativity and Innovation</u>	<u>Information Literacy</u>	<u>Flexibility and Adaptability</u>	<u>Productivity and Accountability</u>
<input checked="" type="checkbox"/> Think Creatively	<input type="checkbox"/> Access and Evaluate Information	<input type="checkbox"/> Adapt to Change	<input type="checkbox"/> Manage Projects
<input type="checkbox"/> Work Creatively with Others	<input type="checkbox"/> Use and manage Information	<input checked="" type="checkbox"/> Be Flexible	<input type="checkbox"/> Produce Results
<input type="checkbox"/> Implement Innovations	<u>Media Literacy</u>	<u>Initiative and Self-Direction</u>	<u>Leadership and Responsibility</u>
<u>Critical Thinking and Problem Solving</u>	<input type="checkbox"/> Analyze Media	<input type="checkbox"/> Manage Goals and Time	<input type="checkbox"/> Guide and Lead Others
<input checked="" type="checkbox"/> Reason Effectively	<input type="checkbox"/> Create Media Products	<input type="checkbox"/> Work Independently	<input type="checkbox"/> Be Responsible to Others
<input type="checkbox"/> Use Systems Thinking	<u>Information, Communications and Technology (ICT Literacy)</u>	<input type="checkbox"/> Be Self-Directed Learners	
<input type="checkbox"/> Make Judgments and Decisions	<input type="checkbox"/> Apply Technology Effectively	<u>Social and Cross-Cultural</u>	
<input checked="" type="checkbox"/> Solve Problems		<input checked="" type="checkbox"/> Interact Effectively with Others	
<u>Communication and Collaboration</u>		<input type="checkbox"/> Work Effectively in Diverse Teams	
<input type="checkbox"/> Communicate Clearly			
<input checked="" type="checkbox"/> Collaborate with Others			

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Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- 30 toothpicks per pair

Set-Up Required:

- Distribute 30 toothpicks into small bags for easy distribution to students.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Think creatively.
- Reason effectively.
- Solve problems.
- Collaborate with others.
- Interact effectively with others.

Cooperative Learning:

- Students will work in pairs.

Expectations:

- Students will discover what an arithmetic sequence is and how to use that knowledge to write an expression describing the pattern.

Timeline:

- 20-30 minutes to complete investigation and class discussion

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Students will begin to see how predictions are made based on the current patterns and trends that are available.

Career Applications

-

Optional or Extension Activities

- Extend the investigation to larger polygons such as heptagons, octagons, nonagons, and decagons.

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Lab Instructions: Haruko's Hexagons

Materials:

- 30 toothpicks in a small plastic bag
- Scratch paper for students
- Calculator

Setup:

1. Put students into pairs.
2. Hand out a bag of 30 toothpicks to each pair.

Instructions:

1. Introduce students to the prompt: "Haruko uses toothpicks to make a pattern of hexagons that look like **a line** of a honeycomb." Emphasize a line, otherwise this will not work.
2. Build out a hexagon with 6 toothpicks, and then another set with 2 hexagons.
3. Have students build what 3 hexagons would look like. Ask: How many toothpicks were needed?
4. On their scratch paper, have them predict how many toothpicks are needed to make 4 hexagons in a row. Have them build it to verify.
5. Repeat with 5 hexagons.
6. Discuss what the pattern is. Ask: What would be the number of toothpicks for 8 hexagons? Have students create a table to verify their answer.
7. Ask: Using what you know so far, how many toothpicks will be needed for 21 hexagons? Give students a few minutes to work.
8. Discuss how students found their answers. If a pair created an equation, ask for their equation and use probing questions to get to why they did what they did. If not, then go ahead and move on to the related lesson.

Optional Extensions:

9. Ask: Can you come up with a rule for how many toothpicks are needed to make n hexagons? Give students a minute to write it down and discuss.
10. Have students create an equation for the number of toothpicks needed to create n heptagons/octagons/nonagons/decagons. Discuss similarities in how the equation was created.
11. Give students a high number of toothpicks (like 100) and have them find how many of a specific polygon (hexagon, heptagon, etc.) they can make.

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WAMC Lesson Plan

Name(s): Angela Frye
Email Address: afrye@freemansd.org
Lesson Title: 1.2 – Describing Arithmetic Patterns
Date: WAMC Summer 2022
Text: Math Medic
STEM Correlation: Engineering
Lesson Length: 30 minutes

Big Idea (Cluster): Generalizing Patterns	
Mathematics K–12 Learning Standards: A-CED.1, F-BF.1.a, F-BF.2	
Mathematical Practice(s): MP1, MP2, MP4, MP7, MP8	
Content Objectives: <ul style="list-style-type: none">Recognize scenarios with a common difference between terms as arithmetic sequences.Describe arithmetic sequences with pictures, tables, words, and graphs.	Language Objectives (ELL): <ul style="list-style-type: none">Students will be able to define and use the vocabulary terms correctly at least 90% of the time.
Vocabulary: <ul style="list-style-type: none">Arithmetic sequenceCommon differenceTerm	Connections to Prior Learning: <ul style="list-style-type: none">Recognition of patternsCreation of table to examine pattern
Questions to Develop Mathematical Thinking: <ul style="list-style-type: none">How do you know this is an arithmetic sequence?What is one way you can find the common difference from a table?What might be a quick way to find a specific term?	Common Misconceptions: <ul style="list-style-type: none">Including first term in term numberMistaking a common ratio with a common difference

Assessment (Formative and Summative):

- Formative: Check Your Understanding worksheet, Quiz after next section
- Summative: Unit 1 Project, Unit 1 Test

Materials:

- Student note sheet
- Check Your Understanding worksheet

Instruction Plan:

Introduction:

Have students get their scratch paper from the lab out.

Say: Let's go back to the lab from yesterday. What was the pattern we found as we added hexagons to the line?

Explore:

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Hand out the student note sheet. Introduce the vocabulary for the section and define them.

Go over the first two examples with students, then give students 5 minutes to complete the rest of the examples. Once students are done, discuss their answers and correct them as needed.

When they are done, have students work on the Check Your Understanding worksheet for the rest of class.

When I observe students:

Students should be collaborating and working together through the example problems and the Check Your Understanding worksheet. I will look for students that are struggling and work one-on-one with them to answer their questions.

Questions to Develop Mathematical Thinking as you observe:

1. How do you know this is an arithmetic sequence?
2. What is one way you can find the common difference from a table?
3. What might be a quick way to find a specific term?

Answers:

1. It has a common difference (value of the terms change by equal amounts).
2. Subtract the second term from the first term.
3. Use the pattern and knowledge of the relationship between multiplication and addition to evaluate the term wanted.

Summarize:

To identify an arithmetic sequence, look for a common difference between consecutive terms. To do this, subtract the second term from the first term, then the third term from the second term. If these two values are the same, then there is a high probability that there is a common difference and therefore, the sequence is arithmetic.

Career Application(s):

- Discuss rates of change for Engineering projects

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Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

- Global Awareness Financial/Economic/Business/Entrepreneurial Literacy Civic Literacy
 Health/Safety Literacy Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION

Creativity and Innovation

- Think Creatively
 Work Creatively with Others
 Implement Innovations

Critical Thinking and Problem Solving

- Reason Effectively
 Use Systems Thinking
 Make Judgments and Decisions
 Solve Problems

Communication and Collaboration

- Communicate Clearly
 Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy

- Access and Evaluate Information

Use and manage Information

Media Literacy

- Analyze Media
 Create Media Products
Information, Communications and Technology (ICT Literacy)
 Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability

- Adapt to Change

- Be Flexible

Initiative and Self-Direction

- Manage Goals and Time

- Work Independently

- Be Self-Directed Learners

Social and Cross-Cultural

- Interact Effectively with Others

- Work Effectively in Diverse Teams

Productivity and Accountability

- Manage Projects

- Produce Results

Leadership and Responsibility

- Guide and Lead Others

- Be Responsible to Others

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