**Unit 1: Investigation 3 (3 Days)**

**ARITHMETIC SEQUENCES**

***CCSS: F-BF 1, F-BF 2***

**Overview**

Students write both the recursive rule and the explicit rule for the nth term of an arithmetic sequence.

**Assessment Activities**

**Evidence of Success: What Will Students Be Able to Do?**

Identify arithmetic sequences, write recursive rules and explicit rules, and use patterns to solve problems.

**Assessment Strategies: How Will They Show What They Know?**

**Exit Slip 1.3** asks students to identify an arithmetic sequence, create its recursive and explicit rules, and use the pattern to solve a problem.

**Journal Entry** prompts students to describe the characteristics of an arithmetic sequence.

**Launch Notes**

You may present a mathematical problem involving toothpicks. Provide each student with 20 toothpicks. Ask students to identify the number of toothpicks required to make a single pentagon. Then ask students to determine the number of toothpicks required to make two adjacent pentagons and three adjacent pentagons. Explain that *adjacent* pentagons are pentagons that share a common edge. Ask students to write their answers on a piece of paper using a table. Tell them to not shout out their answers so all students have an opportunity to solve the problems.

Some students may be more comfortable using paper and pencil for drawing models rather than using toothpicks. Allow students to share their results. Ask students whether they see a pattern in their results. What do they notice about how the number of toothpicks increases?

Ask students how they could use their data to predict the number of toothpicks needed to build 20 pentagons? Inform students that we want to find *rules* which will allow us easily predict values in a pattern. These rules are called *recursive* and *explicit* rules.

**Closure Notes**

Conduct a whole classroom discussion on the relationship between recursive rules and explicit rules. Students should be encouraged to indicate their preferences and their opinion as to the advantages and disadvantages of finding and using each type of rule. **Exit Slip 1.3** **Corn Stalks** may be used in advance of or at the conclusion of the class discussion.

**Teaching Strategies**

1. In **Activity 1.3.1 Recursive and Explicit Rules for Arithmetic Sequences**, students are introduced to basic terminology related to sequences and to recursive and explicit rules. Students are presented with multiple arithmetic patterns to explore and are asked to identify whether or not sequences are arithmetic.
2. In **Activity 1.3.2 Building Bridges**, students explore the arithmetic patterns present in several truss bridge designs. The activity can be supported by YouTube videos of Popsicle stick bridges and their impressive ability to support many times their weights. You may wish to show a sampling of such videos to the class. This activity reinforces students’ ability to create recursive and explicit rules for arithmetic sequences.

**Group Activity**

Arrange students in groups of 3 or 4 and have them work together to complete **Activity 1.3.2 Building Bridges**. The lesson can be complemented by students building toothpick models of the truss bridge designs.

**Differentiated Instruction (Enrichment)**

The *Extension* on the last page of **Activity 1.3.2 Building Bridges** asks students to identify the recursive and explicit rules for the pattern in multilane truss bridges.

1. In **Activity 1.3.3 Arithmetic Sequences with Calculators**, students learn to use the recursive feature of calculators to explore, create, and extend arithmetic sequences. Students must find an appropriate rule and identifying specific terms in an arithmetic sequence.

**Differentiated Instruction (For Learners Needing More Help)**

**Activity 1.3.3 Arithmetic Sequences with Calculators** introduces the use of graphing calculators for extending a recursive pattern. Using the calculator can assist a student having difficulty extending or understanding a pattern.

1. In **Activity 1.3.4 Mohegan Sun Arena**, students use a computer spreadsheet application (for example, Microsoft Excel) to model arithmetic sequences. Students learn how to use spreadsheet formulas to extend arithmetic sequences. Students extend arithmetic sequences to solve a variety of problems. If students don’t have access to a spreadsheet application, the lesson can be taught using graphing calculators.

**Differentiated Instruction (For Learners Needing More Help)**

The teacher may develop a more detailed worksheet with screen captures from Excel as a step-by-step guide for **Activity 1.3.4 Mohegan Sun Arena**. Alternatively, the teacher or students may create a video or podcast that displays step by step instructions for the assignment. This video or podcast would then be made available to any students who request extra help.

**Differentiated Instruction (Enrichment)**

**Activity 1.3.4 Mohegan Sun Arena** does not require “coding” explicit rules in the spreadsheet. Students may wish to experiment with creating cell formulas that are based upon the explicit rule rather than the recursive rule.

**Journal Entry**

1. Describe the characteristics of an arithmetic sequence.
2. Students should record in their journals an example of a recursive rule and an explicit rule that describes the same scenario.

**Resources and Materials**

* **Activity 1.3.1** – Recursive and Explicit Rules for Arithmetic Sequences
* **Activity 1.3.2** – Building Bridges
* **Activity 1.3.3** – Arithmetic Sequences with Calculators
* **Activity 1.3.4** – Mohegan Sun Arena
* **Exit Slip 1.3** – Corn Stalk
* Toothpicks
* Student journals
* LCD Projector
* Teacher computer with Microsoft Excel (or other spreadsheet application)
* Teacher computer with Internet access and speakers (if videos are shown)
* Computer Lab or student computers for Excel exploration and activity
* TI-SmartView Emulator or other means to project or simulate calculator steps
* Graphing calculators

**Photo Credits**

* Image of Shell Creek Bridge (<http://en.wikipedia.org/wiki/File:EJE_Bridge_over_Shell_Creek.jpg>)

Image credit: National Park Service (Public Domain)