**Unit 1 Patterns**

**(4 Weeks)**

**Unit Overview**

This is the introductory unit for the Algebra I course. You will have the opportunity to learn about your students’ mathematical background, ability to work cooperatively, and ability to communicate clearly both orally and in writing. At the same time, you will be inviting students to engage in learning mathematical skills within the context of interesting problems that connect to real world issues. Throughout this course, it is hoped that students recognize and appreciate the power of mathematical thinking and how analyzing mathematical models aids in making important decisions. This unit demonstrates how ubiquitous patterns are in nature and in man-made objects.

The first activity in Investigation 1 focuses on patterns found in hydrocarbons. Students will build models of the molecules of the simple hydrocarbons that are used as fuels. They will create and analyze different representations of patterns – tables, graphs and symbolic rules. They will write the recursive and explicit rules for arithmetic sequences. Students will discover that there is a relationship between the molecular structure of the fuels and the amount of energy produced.

Investigation 2 is designed for students who may have difficulty writing explicit rules. This investigation reviews integers and order of operations. Students are provided an opportunity to strengthen their skills with positive and negative integers by working with algebra tiles.

Investigation 3 delves more deeply into arithmetic sequences and more fully develops students’ skills for writing the explicit rules for a sequence. During this activity students see that many different situations may be represented by an explicit rule.

A mid-unit assessment may be used at this point to check that students can write a recursive rule and understand and use an explicit rule.

Investigation 4 focuses on geometric sequences and how they differ from arithmetic sequences. Students solve several problems in the context of finance, explore using a recursive rule with a calculator and use a spreadsheet to quickly generate a geometric sequence. This investigation foreshadows the development of exponential functions and their applications in Unit 7.

The final investigation, Investigation 5, involves students in an exploration of the patterns found in fractals. Students construct various stages of a fractal as well and explore famous fractals like Sierpinski’s Triangle and the Koch Snowflake. Students analyze the stages of fractals to further understand that not all patterns are arithmetic.

The unit concludes with two different assessments – a performance task and an end-of-unit test. The performance task, which involves honeycomb patterns, assesses the student’s ability to find the *n*th term of a sequence as well as the recognition that not all patterns are linear.

**Essential Questions:**

* What is a sequence?
* How can patterns be represented?
* What are the advantages and disadvantages of a recursive rule compared to an explicit rule?

**Enduring Understandings**

* Analyzing patterns and writing recursive and explicit algebraic rules provides a powerful way to extend patterns and make predictions

**Unit Contents**

Investigation 1: Representing Patterns (2 days)

Investigation 2: Patterns with Integers (2 – 4 days)

Investigation 3: Arithmetic Sequences (3 days)

Mid-Unit Review and Test (2 days)

Investigation 4: Geometric Sequences (2 days)

Investigation 5: Patterns with Fractals (2 days)

Performance Task: Honeycombs (2 days)

End-of-Unit Review and Test (2 days)

**Common Core Standards**

*Mathematical Practices #1 and #3* *describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.*

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others.
4. **Model with mathematics.**
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. **Look for and express regularity in repeated reasoning.**

**Standards Overview**

* Understand the concept of a function and use function notation
* Build a function that models a relationship between two quantities

**Standards with Priority Standards in Bold**

F-IF 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

F-BF 1. Write a function that describes a relationship between two quantities.\*

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.\***

**Vocabulary**

Arithmetic Sequence

Atom

Butane

Energy

Ethane

Explicit Rule

Methane

Fossil Fuel

Fractal

Geometric Sequence

Hexagon

Honeycomb

Hydrocarbon

Ion

Integer

Kilojoule

Mole

Molecular Structure

Molecule

Nth term

Pentagon

Propane

Recursive Rule

Rule of 72

Symbolic Algebraic Expression

Truss Style Bridge

**Assessment Strategies**

**Performance Task: Honeycombs**

 This performance task builds on the unit theme of patterns in nature. The task probes students’ skills in finding the *n*th term of an arithmetic sequence as well as the recognition that not all patterns are linear.

**Other Evidence (Formative and Summative Assessments)**

* Exit Slips
* Class Work
* Homework Assignments
* Math Journals
* Mid-Unit 1 Test
* Unit 1 Test