Unit 1 Patterns

4 Weeks

Connecticut Common Core Algebra I Curriculum

Today's Presenters

Today's Agenda

- Introduction and Unit 1 Overview (30 minutes)
- Unit 1 Workshops
  - Investigation 1: Representing Patterns (30 minutes)
  - Investigation 2: Patterns with Integers (30 minutes)
  - Break (10 minutes)
  - Investigation 3: Arithmetic Sequences (30 minutes)
  - Investigation 4: Geometric Sequences (30 minutes)
  - Break (15 minutes)
- Assessment Review (10 minutes)
- Reflection & Closing (10 minutes)

Unit Content

- 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-Unit Review and Test (2 days)

What Students Need to Know

- Recursive Rule
- Explicit Rule
- Arithmetic Sequence
- Geometric Sequence
- Fractal
- Order of Operations

What Students Need to Be Able to Do

- Determine the recursive and explicit rules for patterns represented in words, images, tables, and graphs
- Determine if a numerical pattern is an arithmetic sequence or a geometric sequence
- Evaluate expressions
- Create fractal designs

Investigation 1: Representing Patterns (2 days)

- Students explore patterns in the molecular structure of hydrocarbons and represent patterns using tables, graphs, equations, and verbal descriptions.
- Students are introduced to the value of representing patterns using multiple representations.

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

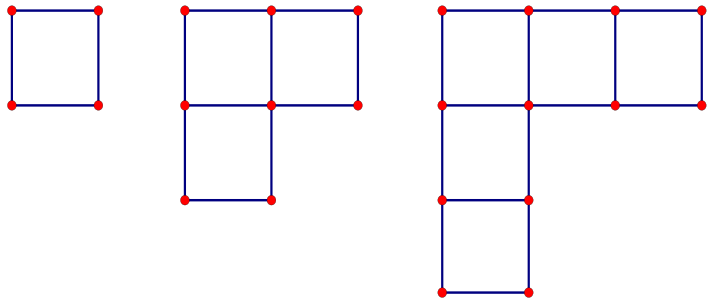
- Students review
  - operations on integers,
  - order of operations,
  - representing algebraic expressions using verbal descriptions, tables, and graphs, and
  - using algebraic expressions to model real-world situations.

Investigation 3: Arithmetic Sequences (3 days)

- Students will write both the recursive rule and the explicit rule for the n^{th} term of an arithmetic sequence.

Mid-Unit Review and Test (2 days)

Jon made marshmallow and toothpick shapes. The first three stages of his pattern are shown below



Stage 1 Stage 2 Stage 3

Stage	# of Toothpicks
1	
2	
3	
4	

1. Extend the pattern and sketch Stage 4.
2. Complete the table.
3. Write a recursive rule for the number of toothpicks.
4. Write an explicit rule for the number of toothpicks, *T*, in each stage, *n*.
5. How many toothpicks would be in stage 8?

Mid-Unit Review and Test (2 days)

- This mid-unit test assesses whether students can:
  - Extend a pattern
  - Write a recursive rule and explicit rule for a pattern
  - Represent patterns using tables and graphs
  - Evaluate a linear expression
  - Use patterns to solve problems

Investigation 4: Geometric Sequences (2 days)

- Students examine geometric sequences through real world applications.

Investigation 5: Patterns with Fractals (2 days)

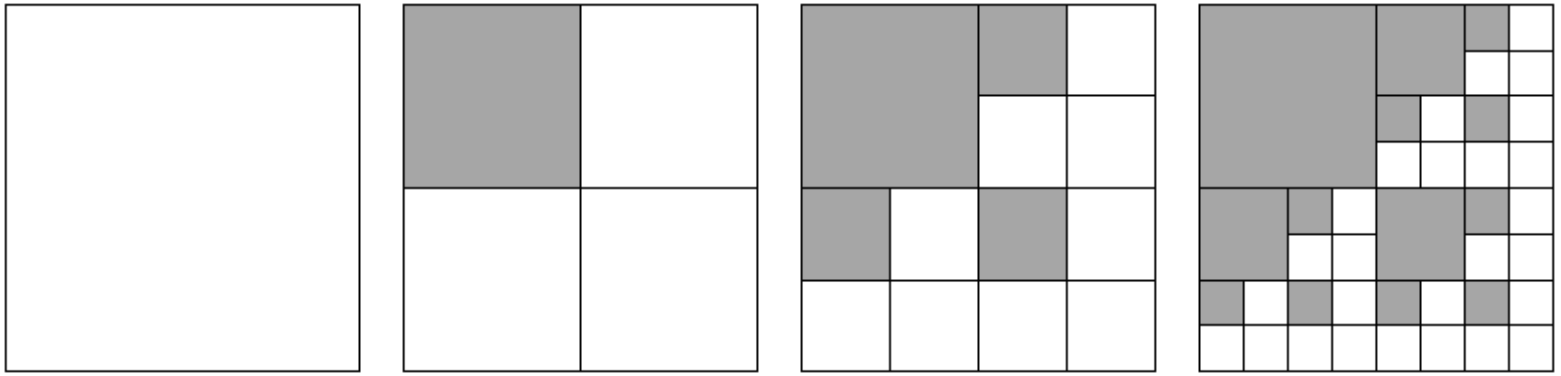
- Students explore geometric patterns of fractal designs.
- Students create pictures of fractals and use tables to represent patterns in fractal designs.

Performance Task: Honeycombs (2 days)

- This performance task:
  - Builds on the unit theme of patterns in nature.
  - Assesses students' ability to find the n^{th} term of an arithmetic sequence and identify geometric and arithmetic sequences.
  - Emphasizes the fact that not all patterns are linear.

End-Unit Review and Test (2 days)

Stages 0 to 3 of a fractal design called "Window Panes" are shown below.



Stage 0 Stage 1 Stage 2 Stage 3

Stage	Total # of Unshaded Squares
0	1
1	3
2	
3	
4	

1. Complete the table. Graph your data.
2. Write a recursive rule to describe the pattern of unshaded squares.
3. Is this pattern an arithmetic or geometric sequence? Explain.
4. Write an explicit rule for the number of unshaded squares, S, in each stage, n.

Essential Questions

- By the end of this unit, students will be able to answer the following 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?

Investigation Exploration

- Participants will break into four groups to explore 4 of the 5 Investigations in Unit 1 (30 minute rotation)
  - Investigation 1: Representing Patterns
  - Investigation 2: Patterns with Integers
  - Investigation 3: Arithmetic Sequences
  - Investigation 4: Geometric Sequences

Assessment Plan

- Investigation 1: Representing Patterns
  - **Exit Slip 1.1** asks student to identify a pattern, represent the pattern using a table and graph, and use the pattern to solve a problem.
  - **Journal Entry** prompts students to identify which representation of patterns is the best for pattern recognition.

Assessment Plan

- Investigation 2: Patterns with Integers
  - **Exit Slip 1.2.1** asks students to perform operations on integers
  - **Exit Slip 1.2.2** asks students to apply order of operations
  - **Journal Entry** prompts students to state rules for adding, subtracting, multiplying and dividing integers and to identify the error in the simplification of an expression.

Assessment Plan

- Investigation 3: Arithmetic Sequences
  - **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.

Assessment Plan

- Investigation 4: Geometric Sequences
  - **Exit Slip 1.4** asks students to find terms in a geometric sequence, identify the recursive rule, represent the sequence using a table and graph, and use the sequence to solve a problem in the context.
  - **Journal Entry** asks students to describe the difference between a geometric and arithmetic sequence and to provide a real-world example of each type of sequence.

Assessment Plan

- Investigation 5: Patterns with Fractals
  - **Exit Slip 1.5** asks students to identify a fractal pattern and use the pattern to make predictions.
  - **Journal Entry** prompts students to define self-similarity in their own words and identify fractals in the real world.

Common Core Content Standards (priority standards are 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.***

Common Core Standards for Mathematical Practice (bold standards to be emphasized)

- *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.**

3-2-1 Reflection in Informal Groups

- List 3 things that correlate between the activities and assessments
- List 2 things to change within activities and assessments based on what you know about the typical student in your class
- List 1 thing that is most helpful to implement within the unit that you intend to bring back to your classroom