# Module 4: Patterns and Sequences

## Learning Goal
The student is expected to identify and construct linear functions, including arithmetic sequences, represented by a graph, description, or two input-output pairs.

## Essential Questions
1. How are patterns and sequences used to solve real-world problems?
2. What is a sequence and how are sequences and functions related?
3. What is an arithmetic sequence?
4. How can you solve real-world problems using arithmetic sequences?

## Unit Overview
This unit provides an opportunity for students to reinforce their understanding of the various representations of a functional relationship – words, concrete elements, numbers, graphs, and algebraic expressions. Students review the distinction between independent and dependent variables in a functional relationship and connect those to the domain and range of a function.

## Vertical Progression
MAFS.8.F.2.4, F.2.5: In Grade 8, students constructed and described qualitatively a functional relationship between two quantities.

## Module Focus Standards
### Algebra 1 Test Item Specs
(Reference Sheet at End)

**MAFS.912.F-BF.1.1a**: (DOK 3) 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.
- Define explicit function and recursive process.
- Write a function that describes a relationship between two quantities by determining an explicit expression, a recursive process, or steps for calculation from a context.

**MAFS.912.F-BF.1.2 (+)**: (DOK 2) Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
- Identify arithmetic and geometric patterns in given sequences.
- Generate arithmetic and geometric sequences from recursive and explicit formulas.
- Given an arithmetic or geometric sequence in recursive form, translate into the explicit formula.
- Given an arithmetic or geometric sequence as an explicit formula, translate into the recursive form.
- Use given and constructed arithmetic and geometric sequences, expressed both recursively and with explicit formulas, to model real-life situations.
- Determine the recursive rule given arithmetic and geometric sequences.
- Determine the explicit formula given arithmetic and geometric sequences.

## Module Topics
### High School Flipbook

#### Identifying and Graphing Sequences (F-IF.1.3, F-BF.1.2, F-LE.1.2)
**Core Resource:**
- Lesson 4.1 (HMH Book)

**Formative Assessments:**
- Lesson Performance Task (HMH pg. 164)
- **Recursive Sequences** - CPALMS
- **Snake on a Plane** – Illustrative Mathematics

#### Constructing Arithmetic Sequences (F-LE.1.2, F-BF.1.1a, F-BF.1.2, F-IF.1.3)
**Core Resource:**
- Lesson 4.2 (HMH Book)

**Formative Assessments:**
- Lesson Performance Task (HMH pg. 174)
- **Table Tiling** - MARS
- **Arithmetic Sequence** - Kuta

#### Modeling with Arithmetic Sequences (F-BF.1.1a, F-LE.1.2, F-IF.1.3)

## Essential Vocabulary
- sequence
- term
- explicit rule
- recursive rule
- arithmetic sequence
- common difference

## Higher Order Question Stems
- How do the important quantities in your problem relate to each other?
- What patterns do you find in . . . ?

## Writing Connections
- Interpret the results of a mathematical situation.
- Write to explain the overall structure and pattern in the mathematics.

[Link to Webb’s DOK Guide]
### Module 4: Patterns and Sequences

<table>
<thead>
<tr>
<th>Core Resource:</th>
<th>Formative Assessments:</th>
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<tbody>
<tr>
<td>Lesson 4.3 (HMH Book)</td>
<td>Lesson Performance Task (HMH pg. 186)</td>
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<tr>
<td>Patchwork - MARS</td>
<td>Furniture Purchase - CPALMS</td>
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- **MAFS.912.F-IF.1.3:** (DOK 2) Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by \( f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) \) for \( n \geq 1 \).

- **MAFS.912.F-LE.1.2:** (DOK 2) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

**Mathematical Practices**
- **MAFS.K12.MP.4.1:** Model with mathematics.
- **MAFS.K12.MP.7.1:** Look for and make use of structure.