Bristol Public Schools

Curriculum Revision-Algebra 2

Student Achievement Committee

10/18/2023

Course Description

Algebra 2 (1.0 Credits)

Students begin the course with a study of sequences, which is also an opportunity to revisit linear and exponential functions. Students represent functions in a variety of ways while addressing some aspects of mathematical modeling. This work leads to looking at situations that are well modeled by polynomials before pivoting to a study of the structure of polynomial graphs and expressions. Students do arithmetic on polynomials and rational functions and use different forms to identify asymptotes and end behavior. Students also study polynomial identities and use some key identities to establish the formula for the sum of the first terms of a geometric sequence.

Next, students extend exponent rules to include rational exponents. They solve equations involving square and cube roots before developing the idea of a number whose square is , expanding the number system to include complex numbers. This allows them to solve quadratic equations with non-real solutions.

Building on rational exponents, students return to their study of exponential functions and establish that the property of growth by equal factors over equal intervals holds even when the interval has non-integer length. They use logarithms to solve for unknown exponents, and are introduced to the number and its use in modeling continuous growth. Logarithm functions and some situations they model well are also briefly addressed.

In accelerated, students learn to transform functions graphically and algebraically. In previous courses and units, students adjusted the parameters of particular types of models to fit data. Here, they consolidate and generalize this understanding. This work is useful in the study of periodic functions that come next. Students work with the unit circle to make sense of trigonometric functions and use those functions to model periodic relationships.

Within the classroom activities, students have opportunities to engage in aspects of mathematical modeling. Additionally, modeling prompts are provided for use throughout the course. Modeling prompts offer opportunities for students to engage in the full modeling cycle. These can be implemented in a variety of ways.

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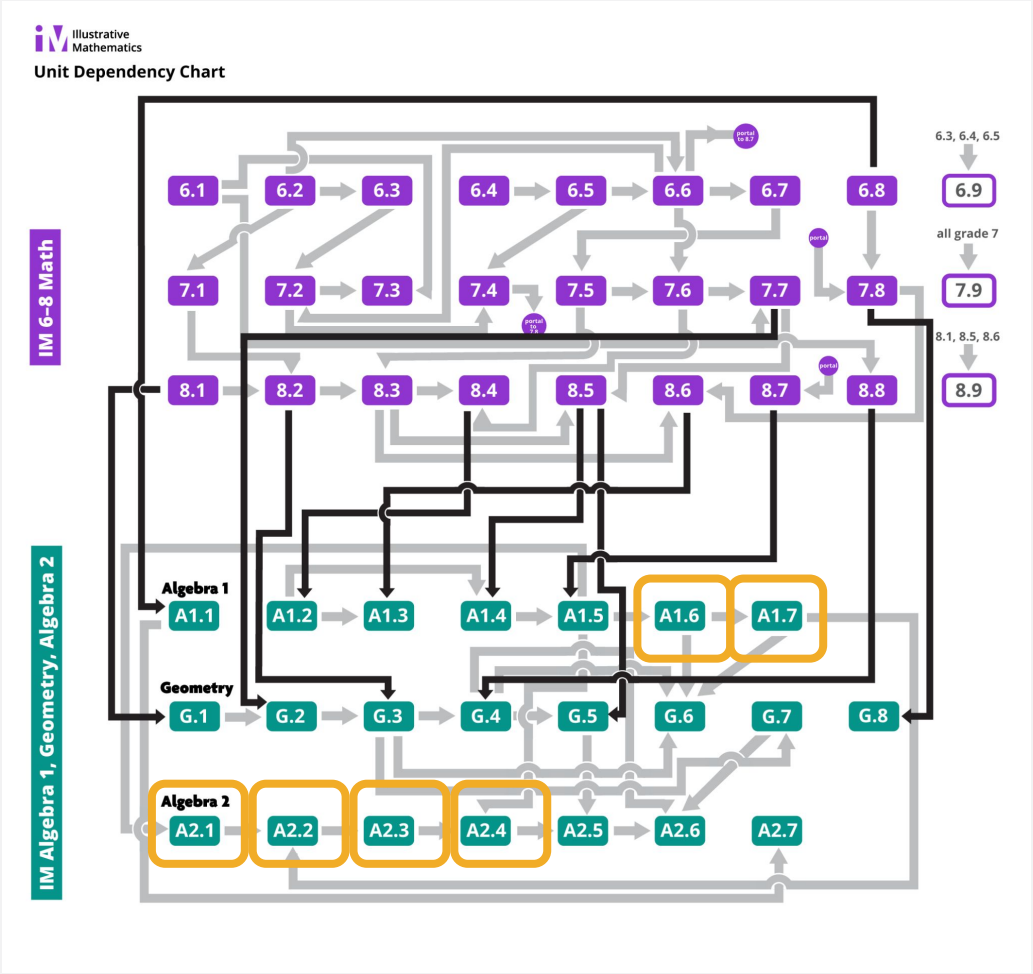
iM Dependency

Academic

Unit 1-Sequences and Functions
Unit 2-Introduction to Quadratic Functions
Unit 3-Quadratic Functions
Unit 4-Complex Numbers and Rational Functions
Unit 5-Exponential Functions



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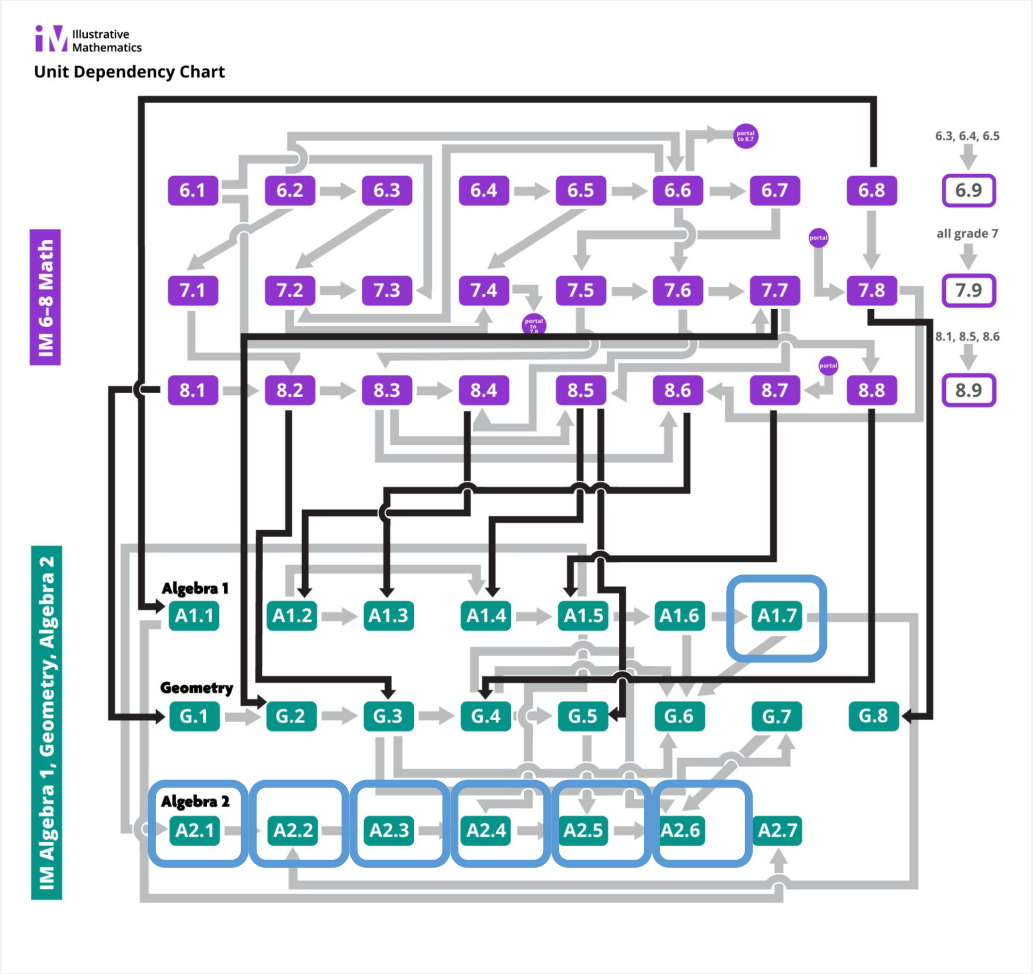
iM Dependency

Accelerated

Unit 1-Sequences and Functions
Unit 2-Quadratic Functions
Unit 3-Complex Numbers and Rational Functions
Unit 4-Exponential Functions
Unit 5-Transformations of Functions
Unit 6-Trigonometric Functions



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Prior Content Algebra 2

Algebra 2 Academic	
Unit	**Title**
1	Operations with Functions
2	Characteristics of Quadratic Functions
3	Solving Quadratic Equations
4	Applications of Quadratic Functions
5	Polynomial Functions
6	Polynomial Expressions and Equations
7	Polynomial Functions
8	Rational Functions
9	Radical Functions

Algebra 2 Accelerated	
Unit	**Title**
1	Searching for Patterns
2	Characteristics of Quadratic Functions
3	Solving Quadratic Equations
4	Polynomial Functions
5	Polynomial Expressions and Equations
6	Polynomial Functions
7	Rational Functions
8	Rational Expressions
9	Radical Functions
10	Graphing Exponential and Logarithmic Functions
11	Exponential and Logarithmic Equations

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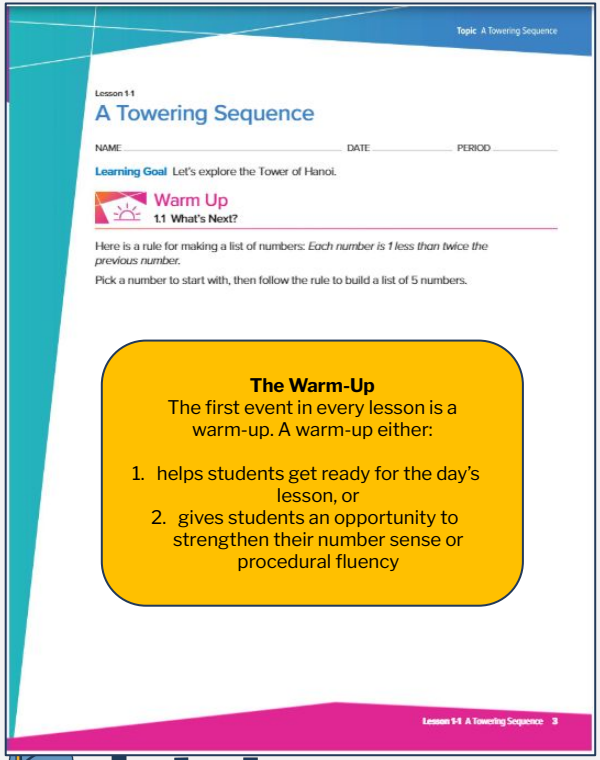
Sample Lesson Trajectory



Topic A Towering Sequence

Lesson 1-1

A Towering Sequence

NAME _____ DATE _____ PERIOD _____

Learning Goal Let's explore the Tower of Hanoi.

Warm Up
1.1 What's Next?

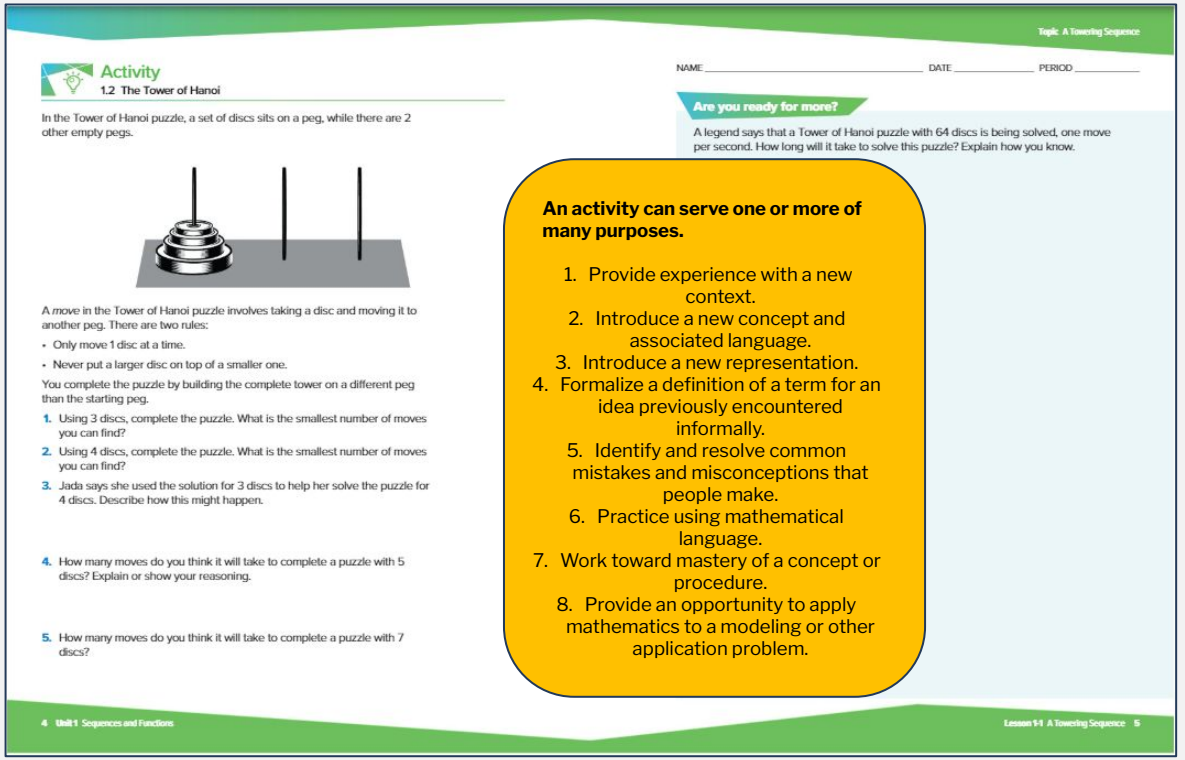
Here is a rule for making a list of numbers: *Each number is 1 less than twice the previous number.*

Pick a number to start with, then follow the rule to build a list of 5 numbers.

Lesson 1-1 A Towering Sequence 3

The Warm-Up
The first event in every lesson is a warm-up. A warm-up either:

1. helps students get ready for the day's lesson, or
2. gives students an opportunity to strengthen their number sense or procedural fluency



Topic A Towering Sequence

Activity
1.2 The Tower of Hanoi

In the Tower of Hanoi puzzle, a set of discs sits on a peg, while there are 2 other empty pegs.

A *move* in the Tower of Hanoi puzzle involves taking a disc and moving it to another peg. There are two rules:

- Only move 1 disc at a time.
- Never put a larger disc on top of a smaller one.

You complete the puzzle by building the complete tower on a different peg than the starting peg.

1. Using 3 discs, complete the puzzle. What is the smallest number of moves you can find?
2. Using 4 discs, complete the puzzle. What is the smallest number of moves you can find?
3. Jada says she used the solution for 3 discs to help her solve the puzzle for 4 discs. Describe how this might happen.
4. How many moves do you think it will take to complete a puzzle with 5 discs? Explain or show your reasoning.
5. How many moves do you think it will take to complete a puzzle with 7 discs?

4 Unit 1 Sequences and Functions

NAME _____ DATE _____ PERIOD _____

Are you ready for more?

A legend says that a Tower of Hanoi puzzle with 64 discs is being solved, one move per second. How long will it take to solve this puzzle? Explain how you know.

Lesson 1-1 A Towering Sequence 5

An activity can serve one or more of many purposes.

1. Provide experience with a new context.
2. Introduce a new concept and associated language.
3. Introduce a new representation.
4. Formalize a definition of a term for an idea previously encountered informally.
5. Identify and resolve common mistakes and misconceptions that people make.
6. Practice using mathematical language.
7. Work toward mastery of a concept or procedure.
8. Provide an opportunity to apply mathematics to a modeling or other application problem.

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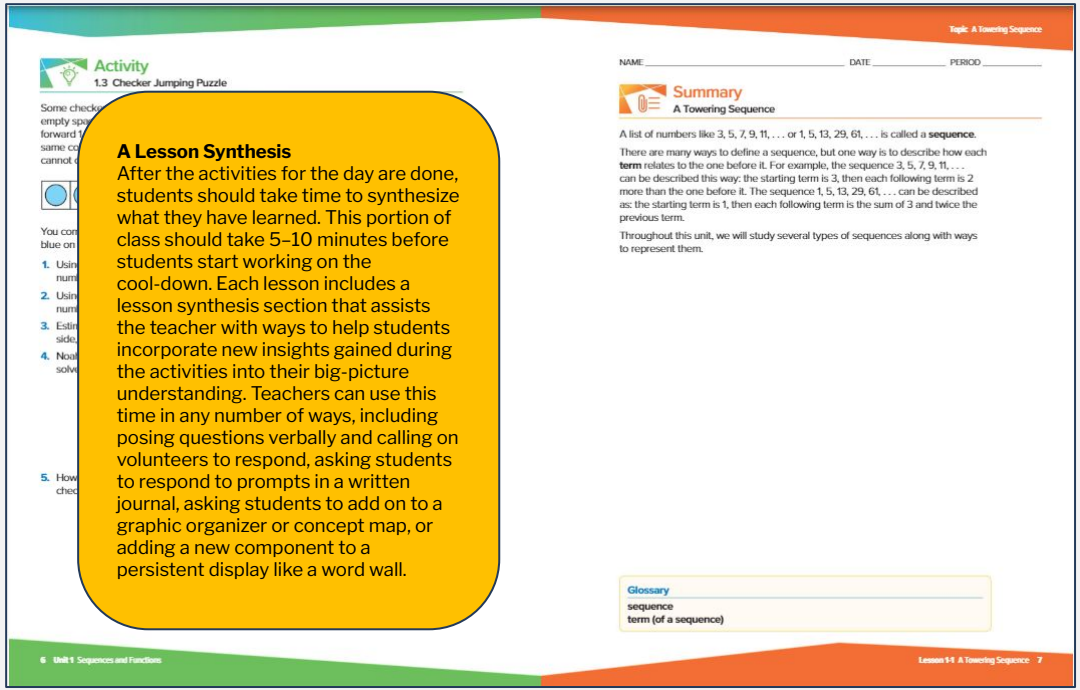
Sample Lesson Trajectory



Topic: A Towering Sequence

Activity
1.3 Checker Jumping Puzzle

NAME _____ DATE _____ PERIOD _____

Summary
A Towering Sequence

A list of numbers like 3, 5, 7, 9, 11, . . . or 1, 5, 13, 29, 61, . . . is called a **sequence**.

There are many ways to define a sequence, but one way is to describe how each **term** relates to the one before it. For example, the sequence 3, 5, 7, 9, 11, . . . can be described this way: the starting term is 3, then each following term is 2 more than the one before it. The sequence 1, 5, 13, 29, 61, . . . can be described as: the starting term is 1, then each following term is the sum of 3 and twice the previous term.

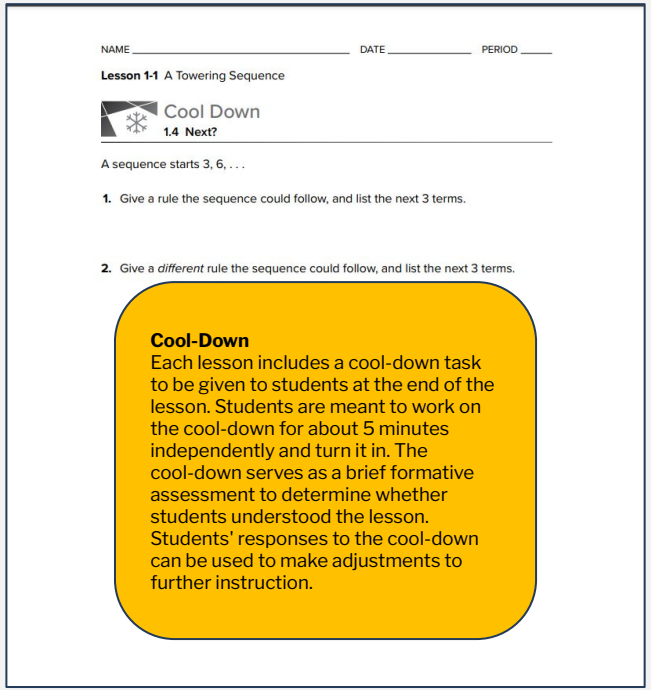
Throughout this unit, we will study several types of sequences along with ways to represent them.

Glossary
sequence
term (of a sequence)

6 Unit 1 Sequences and Functions

Lesson 1-1 A Towering Sequence 7

A Lesson Synthesis
After the activities for the day are done, students should take time to synthesize what they have learned. This portion of class should take 5–10 minutes before students start working on the cool-down. Each lesson includes a lesson synthesis section that assists the teacher with ways to help students incorporate new insights gained during the activities into their big-picture understanding. Teachers can use this time in any number of ways, including posing questions verbally and calling on volunteers to respond, asking students to respond to prompts in a written journal, asking students to add on to a graphic organizer or concept map, or adding a new component to a persistent display like a word wall.



NAME _____ DATE _____ PERIOD _____

Lesson 1-1 A Towering Sequence

Cool Down
1.4 Next?

A sequence starts 3, 6, . . .

1. Give a rule the sequence could follow, and list the next 3 terms.

2. Give a *different* rule the sequence could follow, and list the next 3 terms.

Cool-Down
Each lesson includes a cool-down task to be given to students at the end of the lesson. Students are meant to work on the cool-down for about 5 minutes independently and turn it in. The cool-down serves as a brief formative assessment to determine whether students understood the lesson. Students' responses to the cool-down can be used to make adjustments to further instruction.

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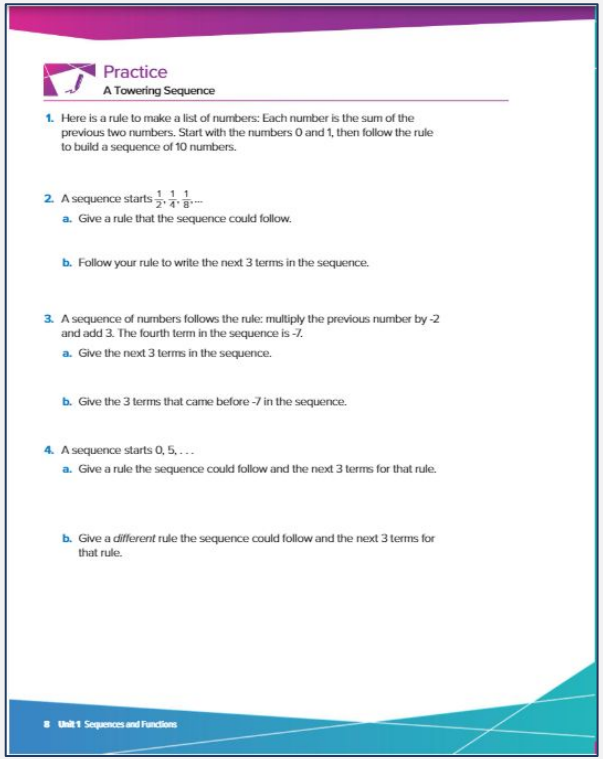
Sample Lesson Trajectory



Practice

A Towering Sequence

1. Here is a rule to make a list of numbers: Each number is the sum of the previous two numbers. Start with the numbers 0 and 1, then follow the rule to build a sequence of 10 numbers.

2. A sequence starts $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$
   a. Give a rule that the sequence could follow.

   b. Follow your rule to write the next 3 terms in the sequence.

3. A sequence of numbers follows the rule: multiply the previous number by -2 and add 3. The fourth term in the sequence is -7.
   a. Give the next 3 terms in the sequence.

   b. Give the 3 terms that came before -7 in the sequence.

4. A sequence starts 0, 5, . . .
   a. Give a rule the sequence could follow and the next 3 terms for that rule.

   b. Give a *different* rule the sequence could follow and the next 3 terms for that rule.

8 Unit 1 Sequences and Functions

Practice Problems

Each lesson includes an associated set of practice problems. Teachers may decide to assign practice problems for homework or for extra practice in class. They may decide to collect and score it or to provide students with answers ahead of time for self-assessment. It is up to teachers to decide which problems to assign (including assigning none at all).

The practice problem set associated with each lesson includes a few questions about the contents of that lesson, plus additional problems that review material from earlier in the unit and previous units. Distributed practice (revisiting the same content over time) is more effective than massed practice (a large amount of practice on one topic, but all at once).

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Sample Assessment Series

CFA 1	CFA 2	CFA 3
Cool Down Lesson 3	Cool Down Lesson 5	Cool Down Lesson 9

Lesson 1-3 Different Types of Sequences

Cool Down

3.4 Do What's Next

Many sequences start with the terms 3 and 6.

1. Find the next two terms of the arithmetic sequence 2, 8, _____, _____.

2. Find the next two terms of the geometric sequence 2, 8, _____, _____.

3. Find two possible next terms of a sequence 2, 8, _____, _____ that is neither geometric nor arithmetic.

Lesson 1-5 Sequences are Functions

Cool Down

5.4 Define This Sequence

Use the first five terms of sequence H to define the sequence recursively using function notation.

2.5, 7.5, 22.5, 67.5, 202.5, . . .

Lesson 1-9 What's the Equation?

Cool Down

9.4 Ow, My Jaw

Here are two definitions of the same sequence.

Definition One: $f(1) = 64$ and $f(n) = \frac{1}{2} \cdot f(n-1)$ for $n \geq 2$

Definition Two: $f(n) = 64 \cdot \left(\frac{1}{2}\right)^{n-1}$ for $n \geq 1$

1. List the first 4 terms of this sequence.

2. Write an expression to represent $f(20)$.

3. A person is trying to quit chewing gum. They decide they will have 64 pieces in week 1, but each week have half as many as the week before. The function f represents the number of pieces of gum they will have in week n. What is a reasonable domain for this function? Explain your reasoning.

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Sample Assessment Series

End of Unit Assessment
See handout

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Areas of Continued Development

1. Addition of Success Criteria
2. CFA selection for the last 2 units of instruction.

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