Unpacked South Dakota State Mathematics Standards

Purpose: *In order for students to have the best chance of success, standards, assessment, curriculum resources, and instruction must be aligned in focus, coherence, and rigor. Unpacked standards documents are intended to help align instruction to the focus, coherence, and rigor of the South Dakota State Mathematics Standards. The standards have been organized in clusters as they are not so much built from topics, but rather woven out of progressions. Not all content in a given grade is emphasized equally in the mathematics standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. To say that some things have greater emphasis is not to say that anything in the standards can safely be neglected in instruction. Neglecting standards will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.*

Domain: Algebra	**Grade Level: 4th Year**

HS4.A.SSE.A Cluster: Write expressions in equivalent forms to solve problems
Students will work with geometric series and summation notation.

This is a SUPPORTING cluster. *Students should spend the large majority of their time (65-85%) on the major work of the grade. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.*

A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
A.SSE.5 Use summation notation to describe the sums in a series.

Aspects of Rigor of Student Learning: (Conceptual, Procedural, and/or Application)

A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

Conceptual Understanding	***Procedural Fluency***	***Application***
Students should be able to derive the formula for the sum of a finite geometric series using vocabulary such as initial term and common ratio.	Students recognize, write, and find nth terms of geometric sequences. Students find sums of finite geometric sequences.	Students use geometric sequences to model real-life problems such as figuring out the formula for fixed mortgage payments.

A.SSE.5 Use summation notation to describe the sums in a series.

Conceptual Understanding	***Procedural Fluency***	***Application***
	Students can use the first term and a common ratio to write a series using summation notation.	

Enacting the Mathematical Practices - Evidence of Students Engaging in the Practices

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.**
    - Applications for series allows students to model real-life situations mathematically. (mortgage payments, end value of an annuity involving compound interest, exponential growth or decay)
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.**
    - Deriving the formula for a finite geometric series requires students to look for and make use of repeated reasoning.

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
In Algebra I students have studied exponential growth and decay, so can identify first terms and common ratios. Students have written arithmetic and geometric sequences both recursively and explicitly. Students have also used arithmetic and geometric sequences to model situations.	Students will transfer previous learning to geometric series.	This is an important concept for Calculus when learning about Riemann sums, series, and sequences.

Vocabulary (key terms and definitions)

- Geometric Sequence
- Geometric Series
- Common ratio
- Initial term
- Summation notation

Relevance, Explanations, and Examples:

Below is an application example.

A social media site's user base has increased 53% per month for the past year. The number of users on January 1 was 50,000. Write an expression to find the total number of users that were added through the month n of the past year.