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: Operations and Algebraic Thinking	Grade Level: 4

4.OA.B Cluster: Generate and analyze patterns

This cluster's focus is to find, extend, and generate patterns to describe numerical and shape patterns. This helps develop a conceptual understanding for all whole-number operations. Students should have an opportunity to extend and describe both physical patterns and numerical patterns.

This is an ADDITIONAL 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.*

4.OA.5 - Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number is 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.

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

Conceptual Understanding	*Procedural Fluency*	*Application*
Understand and explain a given rule that includes shapes or numbers to continue a pattern. **(4.OA.5)**	Complete a pattern with or without the given rule. **(4.OA.5)**	

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

1. **Make sense of problems and persevere in solving them.**
   - Use problems as a context for finding and extending problems
2. **Reason abstractly and quantitatively.**
   - Reason about similarities and generate rules to describe numerical and geometric patterns
3. **Construct viable arguments and critique the reasoning of others.**
   - Use models and tools to describe patterns they find in problems, in numbers, and in geometric figures and to extend patterns to other situations.
4. **Model with mathematics.**
   - Use drawings, lists, and tables to represent patterns.
5. **Use appropriate tools strategically.**
   - Use hundreds charts and counters
6. **Attend to precision.**
   - Describe patterns in a list using appropriate vocabulary.
7. **Look for and make use of structure.**
   - Develop a deeper understanding of the structure of all four operations
8. **Look for and express regularity in repeated reasoning.**
   - Begin to make generalizations by constructing rules for their patterns

Vertical and Horizontal Coherence and Learning Progressions		
Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
Learners will identify and explain mathematical patterns **(3.OA.9)** Learners will determine whether a group of objects (up to 20) has an odd or even number of members **(2.OA.3)**	Numerical patterns reinforce mastery of basic facts and understanding operations Solve multi-step word problems and represent these problems with equations that use variables **(4.OA.3)**	Learners will generate two numerical patterns using two given rules, identify relationships between corresponding terms, and form ordered pairs for graphing on a coordinate plane **(5.OA.3)** Write, read, and evaluate expressions in which letters represent numbers **(6.EE.2)** Use variables to represent two quantities that change in relationship to one another and write expressions to express one quantity in terms of the other quantity **(6.EE.9)** Understand the concept of a ratio and use ratio language to describe a relationship between two quantities **(6.RP.1)**

Vocabulary *(Key Terms Used by Teachers and Students in this Cluster):*

- Composite
- Difference
- Division
- Equation
- Factor

- Multiple
- Multiplication
- Pattern
- Prime number
- Product

- Quotient
- Rule
- Sum
- Term (of a sequence)
- Unknown

Relevance, Explanations, and Examples:

Pattern	Rule	Feature(s)
3, 8, 13, 18, 23, 28, .	Start with 3; add 5	The numbers alternately end with a 3 or an 8
5, 10, 15, 20, …	Start with 5; add 5	The numbers are multiples of 5 and end with either 0 or 5. The numbers that end with 5 are products of 5 and an odd number. The numbers that end in 0 are products of 5 and an even number.

Complete the pattern below:
2, 4, 3, 5, 4, 6, 5, 7, 6, _____, _____, _____, _____

 What was the rule for the pattern in the question above? (***Add 2, subtract 1***)

There are 4 beans in the jar. Each day 3 beans are added. How many beans are in the jar for each of the first 5 days?

Day	Operation	Beans
0	3 x 0 + 4	4
1	3 x 1 + 4	7
2	3 x 2 + 4	10
3	3 x 3 + 4	13
4	3 x 4 + 4	16
5	3 x 5 + 4	19

Achievement Level Descriptors

Cluster: Generate and analyze patterns

Concepts and Procedures	*Level 1:* Students should be able to extend a number or shape pattern that follows a given rule.
	Level 2: Students should be able to generate a number or shape pattern that follows a given rule.
	Level 3: Students should be able to analyze a pattern for apparent features that are not explicit in the rule itself.
	Level 4: