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: Interpreting Functions	**Grade Level: Algebra I**

A1.F.IF.A Cluster: Understand the concept of a function and use function notation.

Understand how to identify a function, how to use function notation, and recognize the elements of a function including sequences.

****This is a MAJOR 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.*

A1.F.IF.A.1: Understand that a function maps each element of the domain to exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

A1.F.IF.A.2: Use function notation, evaluate functions, and interpret statements that use function notation in terms of a context.

A1.F.IF.A.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

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

A1.F.IF.A.1: Understand that a function maps each element of the domain to exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand that a function pairs each input with exactly one output. Understand that f(x) represents an output and x represents an input of the function. Understand that a function denoted as “y = “ is equivalent to a function denoted as “f(x) = “. Understand the domain represents the input (x-values) and the range represents the output (y-values).	Classify a relation as a function or not a function. Identify the domain and range of a function.	

A1.F.IF.A.2: Use function notation, evaluate functions, and interpret statements that use function notation in terms of a context.

Conceptual Understanding	***Procedural Fluency***	***Application***
	Represent ordered pairs in function notation. Ex: (3,7) → f(3) = 7. Write equations/functions in function notation. Evaluate a function written in function notation.	Use a function presented in function notation to answer question based on a real-life context.

A1.F.IF.A.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand that a sequence is a function that pairs each input with exactly one output. Understand how to read a sequence given recursively. Understand that domain is the position of each term in an sequence and the range is the value of the term in the sequence.		

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

1. **Make sense of problems and persevere in solving them.**
   - Use functions in function notation when given real-world situations and interpret the solutions.
2. **Reason abstractly and quantitatively.**
   - Use and interpret function notation to identify relationships between domain and range.
3. **Construct viable arguments and critique the reasoning of others.**
   - Explain and give evidence to prove whether a relation is a function.
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
   - Use mapping diagrams, vertical line test, etc, to help verify a function exists.
6. **Attend to precision.**
7. **Look for and make use of structure.**
8. **Look for and express regularity in repeated reasoning.**

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
In middle school, learners ● analyze proportional relationships and solve real-world math problems using numerical and algebraic expressions and equations ● describe the functional relationship between two quantities qualitatively by analyzing a graph ● construct a function to model	In Algebra 1, learners ● write recursive and explicit formulas for arithmetic and geometric sequences ● write functions for linear, quadratic, and exponential relationships.	In future math courses, learners ● use function notation with all types of functions ● derive the formula for a geometric series.

a linear relationship.		

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

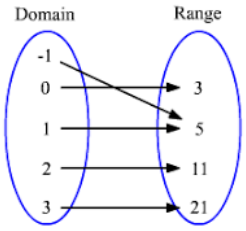
- input
- output
- domain
- range
- relation
- function
- function notation
- sequence

Relevance, Explanations, and Examples:

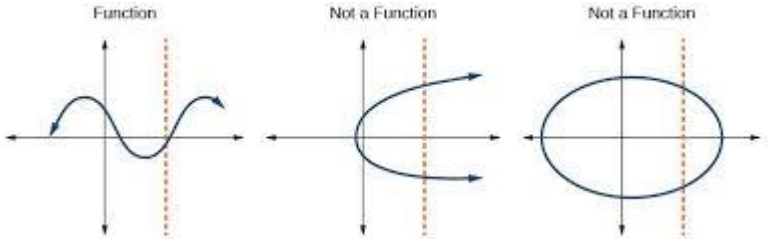
A1.F.IF.A.1: Note: The graph of f is the graph of the equation $y = f(x)$.
This can be interpreted as understanding the graph of f(x) = 3x + 10 can be graphed using y = 3x + 10.

To determine whether a relation is a function or not can be done from a mapping diagram, a vertical line test, among others.

Mapping Diagram



Vertical Line Test



Note: Emphasize the vertical line is used to determine if an input (x-value) has more than one output (y-value).

Express domain and range in three different ways:

- **Set Notation**

Domain: {1,3,5,7}
Range: {2,4,6,8}

- **Inequality Notation**

Domain: {x | 10 < x < 21}
Range: {y | y ≥ -1}

- **Interval Notation**

Domain: (10,21)
Range: $[-1, \infty)$

A1.F.IF.A.3: the position of the term that represents the subset of the integers….

Ex: For the sequence 2, 4, 8, 16,.... the domain and range is defined by:

n	a_n
1	2
2	4
3	8
4	16

Domain (subset of integers) **Range**

**Teacher Note: Every sequence given recursively will produce a function.

Achievement Level Descriptors

Cluster: Understand the concept of a function and use function notation.	
Concepts and Procedures	***Level 1:*** Students should be able to distinguish between functions and nonfunctions. They should be able to state the domain and range given a graph.
	Level 2: Students should understand the concept of a function in order to distinguish a relation as a function or not a function. They should be able to identify domain and range of a function given a graph of a quadratic or linear function and they should understand that the graph of a function $f(x)$ is the graph of the equation $y = f(x)$.
	Level 3: Students should be able to use function notation to evaluate a function given in function notation for a particular input. They should be able to identify the domain and range for any given function presented in any form, e.g., as a graph, a verbal description, or a sequence.
	Level 4: Students should be able to find the input for a given output when given in function notation.