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: The Number System	Grade Level: 6

6.NS.C Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

Students will extend the number line to represent all rational numbers and recognize that number lines may be either horizontal or vertical. Horizontal and vertical number lines help students move from number lines to coordinate grids. They will focus on the relationship between negative and positive numbers and the meaning of absolute value. This cluster will lay the foundation for working with rational numbers, algebraic expressions and equations, functions and the coordinate plane in seventh and eighth grade.

**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.*

6.NS.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
  a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.
  b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
  c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.7 Understand ordering and absolute value of rational numbers.
  a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
  b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.
  c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
  d. Distinguish comparisons of absolute value from statements about order.

6.NS.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Aspects of Rigor for Students: (Conceptual, Procedural, and/or Application)		
Conceptual Understanding	*Procedural Fluency*	*Application*
Understand the meaning behind positive and negative numbers and how they are used to represent quantities. **(6.NS.5)** Understand the concept of opposites in context **(6.NS.5)**		Represent real-world contexts using positive and negative numbers. **(6.NS.5)** Explain what zero means in real-world situations. **(6.NS.5)**
Understand that rational numbers (positive and negative) are points on a number line. **(6.NS.6a)** Extend previous knowledge of number lines in the negative direction. **(6.NS.6a)** Understand that zero is a position on a number line. **(6.NS.6a)** Understand how opposites are located on a number line and zero is its own opposite. **(6.NS.6a)** Recognize that the opposite of an opposite is the number itself (e.g. –(–3) = 3). **(6.NS.6a)**		
Understand that there are four quadrants to the coordinate plane and extend their knowledge of the 1st quadrant by extending it into the four quadrant plane. **(6.NS.6b)** Understand the meaning of negative numbers in ordered pairs and how they indicate quadrant position on the coordinate plane. **(6.NS.6b)** Recognize that when two sets of coordinates only differ by a negative sign(s) then they are reflected across an axis(es) (e.g., (1,5) and (-1, 5) is reflected across the y-axis and (-1,-5) is reflected across both the y-axis then x-axis). **(6.NS.6b)** Recognize that point where the x-axis and y-axis intersect is the origin. **(6.NS.6b)**		
	Find and position integers and other rational numbers on both horizontal and vertical number lines. **(6.NS.6c)** Find and position pairs of integers and other rational numbers (coordinate	

	pairs) on a coordinate plane. **(6.NS.6c)**	
Understand and interpret inequalities as comparing two numbers on a number line (e.g. -10 is to the left of -4, so -4 must be larger). **(6.NS.7a)** Understand as the number line moves to the left (into the negative) the numbers continue to get smaller even though the absolute value of the number is larger. **(6.NS.7a)**		
Interpret and explain the meanings behind inequality statements. **(6.NS.7b)**	Write inequality statements with the appropriate symbols. **(6.NS.7b)**	Write, interpret, and explain inequality statements from real-world contexts. **(6.NS.7b)**
Understand the meaning of absolute value as the distance from 0 on a number line. **(6.NS.7c)** Know the notation for absolute value. **(6.NS.7c)** Understand that distance cannot be negative, which is why absolute values are always positive (since it is describing the distance from zero). This is an example of a real-world absolute value. **(6.NS.7c)**		Use the idea of absolute value in real-world situations and be able to interpret the meaning as a value of magnitude. **(6.NS.7c)**
Understand the proper terminology when making statements about absolute value and statements about order (For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars. Students should recognize that having an account balance of -30 dollars means that they owe 30 dollars, not -30 dollars). **(6.NS.7d)** Know the proper time to make absolute value comparisons from statements of order. **(6.NS.7d)** Understand how absolute value can be used to order rational numbers. **(6.NS.7d)** Explain the reasoning that as a value of a negative rational number decreases its absolute value increases. **(6.NS.7d)**		
	Find distances between points with the same first or the same second coordinate using the idea of absolute value. **(6.NS.8)**	Graph points in all four quadrants of the coordinate plane to solve-real world and mathematical problems. **(6.NS.8)**

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

1. **Make sense of problems and persevere in solving them.**
   - Relate concepts of positive and negative numbers to real-world applications.
2. **Reason abstractly and quantitatively.**
   - Understand the meaning of quantities, not just how to compute them.
   - Understand the meaning of quantities as they relate to the real world.
3. **Construct viable arguments and critique the reasoning of others.**
   - Facilitate a discussion that uncovers the fact that as you move left on the number line, numbers get smaller.
4. **Model with mathematics.**
   - Describe a real-world scenario with number lines and coordinate grids and interpret the results.
5. **Use appropriate tools strategically.**
   - Introduce a 4-quadrant coordinate graph as an extension of their previous use of only quadrant one.
   - Use vertical and horizontal number lines to to order rational numbers.
6. **Attend to precision.**
   - Represent answers depending on the phrasing of the question, the context of the word problem, or the real-world situation.
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 Grade 3, learners show data by making a line plot, where the horizontal scale is marked off in appropriate units. In Grade 3, learners understand a fraction as a number on the number line; represent fractions on a number line diagram. In Grade 5, learners represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	In **6.EE.B.8**, learners recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. In **6.G.3**, learners use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate.	In Grade 7, learners apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line. In Grade 8, learners construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.

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

- Rational Numbers
- Opposites
- Origin
- Quadrants
- Coordinate Plane
- Ordered Pairs

- X-Axis
- Y-Axis
- Coordinates
- Inequalities
- Value

- Greater Than
- Less Than
- Greater Than or Equal To
- Less Than or Equal To
- Absolute Value

Relevance, Explanations, and Examples:

In Grade 6, the students will be formally introduced to the idea of negative numbers and the negative side of the number line. This is a major conceptual understanding piece that will help them understand how to add, subtract, multiply and divide integers in Grade 7.

Discuss the meanings of a minus sign:

Table 1. *Three Meanings of the Minus Sign*

Problem	Meaning of the minus sign
1. 5 – 8 = ☐	Subtraction (a binary operation)
2. ☐ + 5 = -2	Symbolic representation for a negative number
3. Which is larger, - -4 or -4?	The opposite of (a unary operation)

Start on the positive side of a number line and move left, noting that numbers get smaller as we move to the left. Continue on into negative numbers, noting that numbers continue to get smaller (even though the number seems to be growing. -10 is smaller than -5 even though 10 is larger than 5). (ex: 30 > 15 > 0 > -15 > -30) 6.NS.7c

Real life application examples of absolute value: stairs, sea level, distance from home, elevator, bank accounts

Using accurate language to compare absolute values in real-world scenarios (For example: An account balance of $100 is greater than the balance of -$900. 100 > -900, but the amount of debt is greater than the amount of credit. |-900| > |100|)

Achievement Level Descriptors

Cluster: **Apply and extend previous understandings of numbers to the system of rational numbers.**

Concepts and Procedures	
	Level 1: Students should be able to place all integers on a number line and integer pairs on a coordinate plane with one- unit increments on both axes.
	Level 2: Students should be able to apply and extend previous understandings of whole numbers to order rational numbers and interpret statements of their order in the context of a situation. They should be able to place all rational numbers on a number line and integer pairs on a coordinate plane with various axis increments. They should be able to relate changes in sign to placements on opposite sides of the number line and understand the absolute value of a number as its distance from zero on a number line. Threshold:The student who just enters Level 2 should be able to: ● Order fractions and integers. ● Place integer pairs on a coordinate plane with axis increments of 2, 5, or 10.
	Level 3: Students should be able to apply and extend previous understandings of numbers to relate statements of inequality to relative positions on a number line, place points with rational coordinates on a coordinate plane, and solve problems involving the distance between points when they share a coordinate. They should be able to understand absolute value and ordering by using number lines and models and relate reflection across axes to changes in sign. Threshold:The student who just enters Level 3 should be able to: ● Place points with rational coordinates on a coordinate plane and combine absolute value and ordering, with or without models (|-3| < |-5|).
	Level 4: