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: Expressions and Equations	**Grade Level: 6**

6.EE.B Cluster: Reason about and solve one-variable equations and inequalities.

Students focus on the meaning of an equation and use reasoning and prior knowledge to solve it. They use variables to represent numbers and write expressions when solving problems. Students learn to write inequalities in the form of $x > c$, $x \geq c$, $x < c$ or $x \leq c$ and use of number line representation to show the solutions of inequalities.

****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.EE.5 Understand solving an equation or inequality is a process in which you determine values from a set that make an equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

6.EE.8 Write an inequality of the form $x > c$, $x \geq c$, $x < c$ or $x \leq c$ which represents a condition or constraint in a real-world or mathematical problem. Recognize that inequalities have infinitely many solutions; represent solutions of inequalities on number line diagrams.

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

Conceptual Understanding	***Procedural Fluency***	***Application***
Use reasoning to find the **single** value that makes an equation true. **(6.EE.5)** Understand that solutions to **inequalities** represent a **range** of possible values rather than a single solution. **(6.EE.5)**	Use substitution to simplify numerical expressions and determine if solution is true. **(6.EE.5)**	
Understand that a variable represents a number or a specified set of numbers. **(6.EE.6)** Identify what the variable represents. **(6.EE.6)**		Represent real world scenarios with variable expressions. **(6.EE.6)**

	Set up the equation and solve one step equations using visual models or mental math. **(6.EE.7)**	Model real world situations with equations. **(6.EE.7)**
Discover that a variable can stand for an infinite number of solutions when used in inequalities. **(6.EE.8)** Understand the difference between >, ≥, and <, ≤ and graphing with the appropriate open or closed circle. **(6.EE.8)**	Graph solutions of inequalities on a numberline. **(6.EE.8)**	Model real world situations with an inequality. **(6.EE.8)** Discuss the limitations that an inequality represents. **(6.EE.8)**

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

1. **Make sense of problems and persevere in solving them.**
   - Look for meaning in the problems and find effective ways to represent and solve them.
   - Understand what the variable is represented in the problem in front of them stands for in order to make sense of the problem and solve for it. They will be able to explain what the variable represents and how their answer makes sense.
2. **Reason abstractly and quantitatively.**
   - Reason with symbolic representations in equations.
   - Manipulate expressions while keeping equality.
3. **Construct viable arguments and critique the reasoning of others.**
4. **Model with mathematics.**
   - Model real-life situations with mathematics and use variables to represent two quantities in real world contexts.
   - Model their situations using symbols, tables, and graphs.
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
   - Use appropriate vocabulary and translate between verbal and numerical expressions fluently and accurately.
   - Set up expressions, equations, and/or inequalities that represent the correct interpretation of the problem at hand (e.g. 5 - y vs. y - 5).
   - State precisely the meaning of variables they use when setting up equations
7. **Look for and make use of structure.**
   - Apply properties to generate equivalent expressions.
   - Use the structure of the properties to generate the expressions and will need to prove that their expressions are equivalent by using substitution.
   - Interpret the structure of an expression in terms of a context: if a runner is 7t miles from her starting point after t hours, what is the meaning of the 7?
8. **Look for and express regularity in repeated reasoning.**
   - Look for regularity in a repeated calculation and express it with a general formula

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
Students understand what the equal sign is and that it shows equivalence. They have mainly worked on this in grades 4 and 5 within the scope of fractions. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. In Grade 5, students have used visual fraction models to understand the basic idea of using the properties of operations to solve. For example: If 9 people want to share a 50-pound	This cluster really expands on the previous cluster of **6.EE.A.2** where students learned how to read, write and evaluate expressions in which letters stand for numbers. Students are NOT learning how to solve one step equations using the properties of operations yet. To make it more difficult for students, add in fractions and decimals.	In Grade 7, students begin to formally apply the properties of operations. They will solve two step equations in the form of px + q = r and p(x + q) = r. In Grade 8, students solve linear equations in one variable that include one solution, no solution, or infinitely many solutions. They include equations that require the distributive property or combining like terms. In Grade 8, the variable can be on both

sack of rice equally by weight, how many pounds of rice should each person get?	The cluster is truly about reasoning. Students need to understand how to maintain equivalence when working with equations. They may use the properties of operations to solve, but are not explicitly being told that is what they are doing.	sides of the equation. In high school, students further their knowledge of solving equations with multistep problems especially in Algebra.

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

- Equation
- Inequality
- Expressions
- Variables
- Nonnegative Rational Numbers
- Solution
- Solution Set
- Substitution
- Equal
- Solve
- Evaluate

Relevance, Explanations, and Examples:

Instructional Note: According to the 6th grade standards, 6th grade students do not learn to solve equations using the additive or multiplicative inverse. Students may see a pattern and begin to use it, but they are not explicitly taught it this way. Students learn the properties of integers in 7th grade and learn how additive inverses cancel out to zero. After they learn this, they will be able to conceptually understand the process of solving one-step equations.

Examples:

- George paid a total of $15.25 for a pizza with some toppings. The pizza without toppings cost $11.50. Write an equation to show the cost of toppings, t.
- Chase now has a total of $3.25 after his friend gave him $1.12. How much money did Chase begin with before his friend gave him money. Write an equation to show how you solved the problem.
- Connor has a cell phone plan where he pays $55 for unlimited talk time minutes and a total of 30 text messages. Last month Connor sent a total of 48 text messages, so he needs to pay $0.08 for every text message sent over the 30 allotted. Write an equation to show what Connor will need to pay the phone company. Now solve.
- A student company charges a $5 flat fee plus $3 per window to wash windows. How much more would someone have to pay to have 35 washed than 24 windows? Write equations to support your answer. Could someone pay $87 to have their windows washed? Justify your answer.
- Gloria raised $90 for a charity. This is ⅔ the amount that Fiona raised for the charity. Write and solve an equation to determine the amount, d, in dollars that Fiona raised for the charity.

We are looking for the number of cherries in the fruit salad and will introduce a variable to relate the number of pieces of each fruit. If we let our variable denote the number of cherries then a some work is needed to set up our relationship because the first sentence in the problem deals with blueberries and raspberries. There are twice as many raspberries as blueberries so it is natural to let x denote the number of blueberries. Then we find the following:

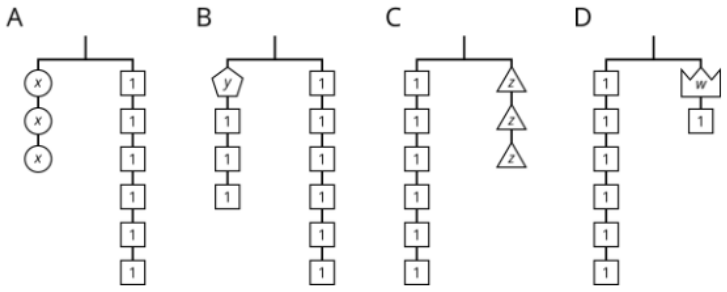
Fruit	Number of pieces
Blueberries	x
Raspberries	$2x$
Cherries	$8x$
Grapes	$24x$

Adding up the total number of pieces of fruit gives $35x$. We have 280 pieces of fruit total so we want to solve

$$35x = 280.$$

So $x = 280 \div 35 = 8$. There are 8 times as many cherries as blueberries so there are 64 cherries.

Student-Facing Task Statement



1. Match each hanger to an equation. Complete the equation by writing x, y, z, or w in the empty box.

$\square + 3 = 6$ $\quad 3 \cdot \square = 6$ $\quad 6 = \square + 1$ $\quad 6 = 3 \cdot \square$

2. Find a solution to each equation. Use the hangers to explain what each solution means.

Instructional Notes: A key learning for 6th grade is that students understand that substitution is a way to understand that their answer was reasonable and accurate.

Number talks would be helpful to discuss different ways students arrive at solving for a variable. This discussion has potential to lead into solving equations using inverse operations, preparing them for 7th grade.

Students learn to use either a dot for multiplication, e.g., 1 · 2 · 3 instead of 1 × 2 × 3, or simple juxtaposition, e.g., 3x instead of 3 · x

Achievement Level Descriptors	
Cluster: **Reason about and solve one-variable equations and inequalities.**	
Concepts and Procedures	***Level 1:*** Students should be able to use substitution to determine when a given number makes an equation or inequality true.
	Level 2: Students should be able to solve one-variable equations and inequalities of the form x + p =/≤/≥/</> q or px = /≤/≥/</> q, where p and q are non negative rational numbers. They should be able to identify and use variables when writing equations.
	Level 3: Students should be able to write one-variable equations and inequalities of the form x + p =/≤/≥/< > q or px =/≤/≥/</> q, where p and q are nonnegative rational numbers. They should be able to reason about and solve equations and inequalities by writing and graphing their solutions on a number line.
	Level 4: Students should be able to solve equations and inequalities of the form x + p = /≤/≥/</> q or px = /≤/≥/</> q, where p and q are rational numbers. They should be able to write and graph solutions on the number line.