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: Reasoning With Equations and Inequalities	**Grade Level: Algebra I**

A1.REI.D Cluster: Represent and solve equations and inequalities graphically.

Understand the solutions to a two-variable equation produce a graph. Explain how a solution to one variable equations can be found by observing the intersection of the graphs. Graph linear inequalities and systems of linear 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.*

A1.REI.D.10*:* Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A1.REI.D.11.(i)*:* Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, including but not limited to using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, quadratic and exponential.

A1.REI.D.12*.* Graph a linear inequality (strict or inclusive) in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

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

A1.REI.D.10*:* Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand that a solution to an equation in two variables is an ordered pair. Understand that an equation in two variables has many possible solutions, all of which lie on the curve or line of the graph of that equation.		

A1.REI.D.11.(i)*:* Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, including but not limited to using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, quadratic and exponential.

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand that you can graph the	Graph linear, quadratic, and/or	

functions created by the expressions on the left side and the the right side of an equation as two curves (or lines). Understand the x-value from the intersection of the graph of the functions created by the left and right sides of the equation is the solution to the equation.	exponential functions (with and without technology). Produce a table of values for linear, quadratic, and/or exponential functions (with and without technology). Identify the x-value of the intersection of the graph or table of the functions created from the left and right side of the equation.	

A1.REI.D.12. Graph a linear inequality (strict or inclusive) in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand that graphing a linear inequality is similar to graphing a linear equation. Understand when a linear inequality: ● produces a solid line ● produces a dashed line ● shades the y-values above the line ● shades the y-values below the line Understand the solution to a linear inequality is a half plane. Understand an ordered pair in the shaded region is a solution to the inequality. Understand the solution to a system of linear inequalities is the intersection of the shaded regions.	Graph a linear inequality. Graph a system of linear inequalities. Identify solutions to a linear inequality. Identify solutions to a system of linear inequalities.	

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.**
    - Explain why the x-value of the intersection of the graphs of the functions created by the expressions of the left and right sides is the solution to the equation.
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
    - Use graph paper and/or technology to graph linear inequalities and systems of linear inequalities.
6. **Attend to precision.**
    - Graph systems of linear inequalities precisely to find the range of solutions.
7. **Look for and make use of structure.**
    - Solve an equation by recognizing an equation is composed of equivalent expressions that can be graphed to find the intersection (the x-value = solution).
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 grades, learners 1. use variables to write expressions, equations, and inequalities 2. graph one variable inequalities on a number line 3. graph linear equations 4. graph systems of linear equations.	In Algebra 1, learners 1. interpret statements, key features, and solutions of linear, quadratic, and exponential functions in terms of context 2. graph linear, quadratic, and exponential functions 3. create linear, quadratic, and exponential functions 4. use graphs of linear, quadratic, and exponential functions to solve real-world contexts.	In future math classes, learners 1. apply these principles to different types of functions.

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

- linear inequality
- systems of linear inequalities
- strict inequality
- inclusive inequality
- half-plane

Relevance, Explanations, and Examples:

A1.REI.D.11 (i): Please be sure the students are aware that the process of finding the x-value by graphing the left and right expressions is true for more than linear, quadratic, and exponential models. (ex: rational, trigonometric, absolute value, cubic, quartic)

A1.REI.D.12: A *strict inequality* uses greater than (>) or less than (<) symbols. An *inclusive inequality* uses greater than or equal to (≥) or less than or equal to (≤) symbols.

Achievement Level Descriptors

Cluster: **Represent and solve equations and inequalities graphically.**

Concepts and Procedures	***Level 1:*** Students should be able to represent a linear equation with an integer-valued slope in two variables graphically on a coordinate plane.
	Level 2: Students should be able to represent linear equations and inequalities and quadratic equations with integer coefficients in one and two variables graphically on a coordinate plane and should understand that the plotted line or curve represents the solution set to an equation. They should be able to graph and estimate the solution of systems of linear equations.
	Level 3: Students should be able to represent exponential functions graphically. They should be able to graph and estimate the solution of systems of equations and systems of linear inequalities. They should understand that the plotted line, curve, or region represents the solution set to an equation or inequality.

	Level 4: Students should be able to explain why the x-coordinates of the points where $f(x)$ and $g(x)$ intersect compose the solution to $f(x) = g(x)$.