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: Algebra		**Grade Level: 4th Year**
HS4.A.REI.A Cluster: Solve systems of equations. Using the standards in this cluster, students can setup and solve matrix equations to solve systems of linear equations.		
This is a SUPPORTING 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.* **A.REI.8** Represent a system of linear equations as a single matrix equation in a vector variable. **A.REI.9** Use matrices to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).		
Aspects of Rigor of Student Learning: (Conceptual, Procedural, and/or Application)		
A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.		
Conceptual Understanding	***Procedural Fluency***	***Application***
Students should understand that a system of linear equations can be expressed as a matrix of coefficients multiplied by a vector matrix of variables equal to a vector matrix of solutions.	Write a system of linear equations as a matrix equation.	
A.REI.9 Use matrices to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).		
Conceptual Understanding	***Procedural Fluency***	***Application***
Students should understand that multiplying both sides of a matrix equation by the inverse matrix solves the equation for the vector variable.	Students should be able to solve a matrix equation (using technology when appropriate).	
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.**		

4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
    - Students should identify the benefits and drawbacks of a matrix solution versus a substitution or elimination solution.
6. **Attend to precision.**
7. **Look for and make use of structure.**
    - Students must be able to format the linear equations to facilitate the creation of the matrix equation.
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***
Students will have solved systems of linear equations using other methods.	In this course, students are introduced to matrices, learn the structure of matrices, learn to mathematically manipulate matrices, and solve matrix equations. Students should be able to compare and contrast the benefits of solving linear systems using matrices compared to using substitution or elimination methods.	Students can use this process to find the equation of any polynomial curve given one more point than the order of the polynomial.

Vocabulary (key terms and definitions)

- Matrix
- Inverse matrix
- Vector matrix

Relevance, Explanations, and Examples:

$$3x + 6y = 9$$
$$7x - 5y = 12$$
$$\begin{bmatrix} 3 & 6 \\ 7 & -5 \end{bmatrix} \times \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 9 \\ 12 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & 6 \\ 7 & -5 \end{bmatrix}^{-1} \times \begin{bmatrix} 9 \\ 12 \end{bmatrix}$$