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: Geometry		**Grade Level: Geometry**
G.G.MG.A Cluster: Applying geometric concepts in modeling situations Modeling is the process of choosing and using appropriate mathematics to analyze situations, to understand them better, and to improve decisions. Modeling links classroom mathematics to everyday life, work, and decision making. Mathematical objects that represent a situation from outside mathematics can be used to model and solve problems. Modeling often involves making simplifying assumptions and sometimes minimizes or disregards some features of the situation being modeled. Modeling is best interpreted not as a collection of isolated topics, but in relation to other standards as well.		
****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.* **G.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). * **G.G.MG.A.2** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). * **G.G.MG.A.3** Apply geometric concepts to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *		
Aspects of Rigor: (Conceptual, Procedural, and/or Application)		
G.G.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). *		
Conceptual Understanding	***Procedural Fluency***	***Application***
Geometric shapes can model objects.	Draw a diagram to model information given in a problem solving question and label the dimensions.	Calculate volume of a tree trunk by modeling it as a cylinder. Calculate volume of the moon by modeling it as a sphere.
G.G.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). *		
Conceptual Understanding	***Procedural Fluency***	***Application***
Density is a compound unit relating two quantities i.e. mass and volume. Compound units (density) can be	Area and volume models for various shapes will be used enhancing fluency.	Compare population density of different regions. Assess reasonableness of models

used to model quantities.	Use dimensional analysis to determine appropriate unit conversions.	and conclusions drawn from real-world situations.

G.G.MG.A.3 Apply geometric concepts to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *

Conceptual Understanding	***Procedural Fluency***	***Application***
Identify appropriate model(s) for a given design problem.		Solve design problems using geometric modeling based upon constraints such as cost, minimum or maximum size, etc. Explain how design decisions address the context and constraints of a given situation.

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

1. **Make sense of problems and persevere in solving them.**
    - Learners will need to understand the problems and make sense of how geometry might be used to solve the problems.
    - Learners must be challenged to develop deep understanding through exploring a range of tasks that require problem solving.
2. **Reason abstractly and quantitatively.**
    - Make sense of formulas and the relationships among them when determining an appropriate model.
    - Assess reasonableness of conclusions about real world situations.
3. **Construct viable arguments and critique the reasoning of others.**
    - Learners will need to justify the designs they create and how they answer the problems.
4. **Model with mathematics.**
    - <u>Primary focus of cluster</u>: learners select and justify an appropriate mathematical model for a range of tasks.
5. **Use appropriate tools strategically.**
    - Learners might use dynamic geometry software or grid paper in order to help understand the real world data that is often messy and three-dimensional situations that may be difficult to visualize.
6. **Attend to precision.**
    - Learners strategically select simplifying assumptions based on features of the situation being modeled.
    - Learners consider appropriate precision for solution (exact vs. rounding) and recognize effect of precision in initial measurements and subsequent calculations.
    - Learners select appropriate units of measure. Precise use of compound units is often required.
7. **Look for and make use of structure.**
    - Learners need to carefully attend to the structure of elements in the problems, how they are related geometrically, and properties that can be used to aid in the design process.
8. **Look for and express regularity in repeated reasoning.**
    - Compare models to identify which one(s) may be equivalent and recognize which models are more efficient for complex calculations.

Vertical and Horizontal Coherence and Learning Progressions

<u>Previous Learning Connections</u>	***<u>Current Learning Connections</u>***	***<u>Future Learning Connections</u>***
In grades 7 and 8, learners work with formulas for area, perimeter, surface area and volume, solving real world and mathematical problems. **(7.G.4, 7.G.5, 7.G.6, 8.G.4)**	Learners have been modeling throughout the course with many standards and focus on using skills to model real world situations in this cluster.	More complex modeling will be used in statistics, physics, trigonometry, and calculus. Modeling is a mathematical skill that learners will use in CTE and beyond high school to approach real-world problems analytically.

Vocabulary (key terms and definitions)	
• density • dimensional/unit analysis • compound unit	
Relevance, Explanations, and Examples:	
Learners may be familiar with the concept of density (d=m/v) from a science class but may have difficulty thinking of density in other contexts such as population density. Modeling density can also be connected to prior learning on ratios, rates and proportions. Learners are familiar with properties of shapes such as area, perimeter, and volume from middle school and this prior learning of these concepts and formulas must be connected to real-world applications from a variety of backgrounds. Use of physical models of area, surface area, volume would be helpful to visualize and select appropriate mathematical models. Graphing utilities, spreadsheets, and/or dynamic geometry software can be powerful tools for the modeling process.	
Achievement Level Descriptors	
Cluster: Applying geometric concepts in modeling situations	
Concepts and Procedures	***Level 1:***
	Level 2:
	Level 3:
	Level 4: