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: 6**
6.G.A Cluster: Solve real-world and mathematical problems involving area, surface area, and volume. This cluster builds on previous understanding of area and volume to deepen the understanding of volume and develop the concept of surface area. Students use knowledge and skills to solve real-world and mathematical problems and apply the concepts by manipulating nets, cubes, and other real-world materials.	
****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.* **6.G.1** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. **6.G.2** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = lwh and V = Bh where B is the area of the base to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. **6.G.3** Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. **6.G.4** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	
Aspects of Rigor for Students: (Conceptual, Procedural, and/or Application)	
Conceptual Understanding	***Procedural Fluency*** / ***Application***
Visualize how familiar shapes can be put together (composed) to form any shape. **(6.G.1)** Understand how to find areas of all triangles, special quadrilaterals [1], and polygons by composing and decomposing. **(6.G.1)** Discover and develop formulas for triangles and parallelograms. **(6.G.1)**	Calculate the areas of all triangles, special quadrilaterals, and polygons using the correct formulas. **(6.G.1)** Apply the techniques for finding areas (using composition and decomposition) in the context of solving real-world and mathematical problems. **(6.G.1)**

Understand how to find the volume of right rectangular prisms with fractional edge lengths by packing unit cubes of the appropriate fractional lengths. **(6.G.2)** Derive the formula by stacking the unit blocks (V=lwh) or by finding the area of the base and stacking the base to fill the prism (V=Bh). **(6.G.2)**.	Calculate the volume of rectangular prisms with fractional edge length by using the formulas. **(6.G.2)**	Apply the formulas for volume of rectangular prisms with fractional edge lengths in the context of real-world and mathematical problems. **(6.G.2)**
Discover the length or distance between two points (vertices) that make up the side of the polygon as long as the coordinate pairs have the same x or y value. This makes them follow along the grid lines. **(6.G.3)**	From coordinates (ordered pairs), draw polygons in any quadrant of the coordinate plane. **(6.G.3)**	Apply to real-world context and mathematical problems. **(6.G.3)**
Decompose three-dimensional figures to form nets. Create or draw the nets to discover the two-dimensional shapes that form the figures. **(6.G.4)** Represent three-dimensional shapes by drawing or folding nets. **(6.G.4)** Understand that there are multiple nets that can form the same figure. **(6.G.4)** Understand that the area of the net is the same as the surface area of the three-dimensional figure. **(6.G.4)**	Calculate surface area using nets. **(6.G.4)**	Apply finding surface area from nets to real-world contexts and mathematical problems. **(6.G.4)**

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.**
   - Use a variety of of models, drawings and real-world figures to solve surface area problems.
3. **Construct viable arguments and critique the reasoning of others.**
   - Learners will use variety and creativity in forming many nets of the same figure and explain the reasons why they form the same figure to others.
4. **Model with mathematics.**
   - Use real-world three-dimensional objects to create nets and find surface area.
5. **Use appropriate tools strategically.**
   - Use physical objects or construct nets to calculate surface area of three-dimensional objects.
   - Use unit cubes to build the base (B) of a rectangle then stack cubes for the height to find the volume of rectangular figures.
6. **Attend to precision.**
   - Use correct vocabulary to talk about the parts of a net and describe how to solve surface area.
   - Learners should use label units correctly.
7. **Look for and make use of structure.**
   - Compose and decompose two and three-dimensional figures to solve real-world problems for area and volume.
   - When constructing pyramids, students will display an equal number of sides for the number of edges in the base. (Example: The net of a rectangular pyramid should have four triangles in the net whereas the net of a triangular pyramid should have three triangles).
8. **Look for and express regularity in repeated reasoning.**

- Learners should begin to derive the formula for volume by repeatedly stacking the base of different rectangular figures.

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
Learners build on their knowledge of area from Grade 3 where they count the area of a rectangle and connect it to their understanding of multiplication in Grade 4. Learners understand how to find the volume of right rectangular prisms with whole numbers in Grade 5. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. **(4.MD.3)**	Learners are flexible using the terms base and length when solving for the area of a two or three-dimensional shape. Develop the concept of surface area. Learners understand how to find the volume of right rectangular prisms using fractions in the length of the edges. Connects to lessons on negative integers **(6.NS.8)** and graphing points in all quadrants.**(6.RP.3.a)** Find distance on coordinate plane by counting the units on the coordinate plane (no formula). Create polygons in quadrants I, II, III, and IV so learners can apply their knowledge of absolute value. **(6.NS.7)**	In Grade 7, learners will continue to draw, construct, and describe geometrical figures and discover relationships between them (without nets). Calculate and compare the volume of cones, cylinders, and spheres. **(8.G.C.9)** Prepare for grade 8 work with transformations by working with polygons in coordinate plane. Learners will further their knowledge on distance in 8th grade when they start to find the lengths of diagonal lines. Learners will use their knowledge of the Pythagorean Theorem to find distance on the coordinate plane and later use the distance formula. In high school, learners will apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). In high school, learners will give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. In high school, students will use the idea of nets to identify the shapes of two-dimensional cross-sections of three- dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

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

- Area
- Congruent Figures
- Net
- Parallel Lines
- Polygon
- Prism
- Quadrilateral
- Right Rectangular Prism
- Similar Figures
- Surface Area
- Volume
- Face
- Edge
- Vertices/Vertex

Relevance, Explanations, and Examples:	
1. Special quadrilaterals are the following shapes: parallelogram, kite, rhombus, trapezoid, rectangle, or square. The work students do with nets in Grade 6 will set the foundation for being able to visualize three-dimensional figures which will be beneficial for future geometry concepts, including cross sections and rotating two-dimensional shapes. When finding the area of a quadrilateral, the terms (base X height) and (length X width) are interchangeable. Without context, learners need to know that they are the same. As the learners move into Geometry they will use base = B meaning area of a two-dimensional base versus b as the side length.	
Achievement Level Descriptors	
Cluster: **Solve real-world and mathematical problems involving area, surface area, and volume.**	
Concepts and Procedures	***Level 1:*** Students should be able to find areas of right triangles; draw polygons with positive coordinates on a grid with a scale in one-unit increments, given nonnegative integer-valued coordinates for the vertices; and find the volume of right rectangular prisms with one side expressed as a fraction or a mixed number in halves or fourths.
	Level 2: Students should be able to find areas of special quadrilaterals and triangles; draw polygons in the four-quadrant coordinate plane with scales in one- unit increments, given integer-valued coordinates for the vertices; and find the volume of right rectangular prisms with one side expressed as a fraction or a mixed number.
	Level 3: Students should be able to solve problems that involve finding areas of polygons and special quadrilaterals and triangles and find the volume of right rectangular prisms with all sides expressed as a fraction or a mixed number. They should be able to solve problems by drawing polygons in the four- quadrant coordinate plane with scales in various integer increments, given integer-valued coordinates for the vertices or coordinates containing a mix of integers and half, quarter, or tenth units.
	Level 4: Students should be able to solve problems by finding surface areas of three-dimensional shapes composed of rectangles and triangles. They should be able to find the volume of a compound figure composed of right rectangular prisms to solve problems.