Unpacked South Dakota State Mathematics Standards DONE

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: 8**

8.G.A Cluster: Understand congruence and similarity using physical models, transparencies, or geometry software.

Describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Explain and understand angle relationships.

****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.*

8.G.1 Verify experimentally the properties of rotations, reflections, and translations.
- **a.** Lines are mapped to lines, and line segments to line segments of the same length.
- **b.** Angles are mapped to angles of the same measure.
- **c.** Parallel lines are mapped to parallel lines.

8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

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

Conceptual Understanding	***Procedural Fluency***	***Application***
Understand rotations, reflections, and translations produce: 1. line segments that are the same measure **(8.G.1a)** 2. angle measures that are the same measure **(8.G.1b)** 3. parallel lines that remain		

parallel **(8.G.1c)**		
Understand that figures are congruent if a transformation (or a sequence of transformations) maps one figure onto another figure. **(8.G.2)** **Note: Transformations include:** **1. Reflection** **2. Rotation** **3. Translation**	Describe the transformation (or the sequence of transformations) that maps one congruent figure onto another. **(8.G.2)** **Note: Transformations include:** **1. Reflection** **2. Rotation** **3. Translation**	
Understand how a dilation, translation, rotation, and reflection affect the coordinates of a figure. **(8.G.3)**	Describe what happens to the coordinates when a figure is dilated, translated, rotated, or reflected. **(8.G.3)**	
Understand that figures are similar if a transformation (or a sequence of transformations) maps one figure onto another figure. **(8.G.4)** **Note: Transformations include:** 1. Reflection 2. Rotation 3. Translation **4. Dilation**	Describe the transformation (or the sequence of transformations) that maps one similar figure onto another. **(8.G.4)** **Note: Transformations include:** 1. Reflection 2. Rotation 3. Translation **4. Dilation**	
Understand the angle sum is 180 degrees for: **(8.G.5)** 1. a linear pair of angles 2. interior angles of a triangle Understand the relationship between interior and exterior angles of a triangle. **(8.G.5)** Understand the relationship among angles created when parallel lines are cut by a transversal. **(8.G.5)** Understand that only two sets of congruent angles are needed to establish similar triangles. **(8.G.5)**		

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 to other students a sequence of transformations.
    - Explain to other students the relationship between angles that are formed when a transversal cuts a set of parallel lines.
    - Critique other students' explanations and justifications.
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
    - Identify and use appropriate tools, such as: patty paper (parchment paper), angle ruler, geometric software, graph paper

6. **Attend to precision.**
    - Communicate precisely with others by using clear mathematical language when describing transformations (such as: turn becomes rotate, rotate becomes rotate 90 degrees clockwise).
7. **Look for and make use of structure.**
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 4th-7th grade, learners 1. draw, construct, and describe geometric figures (such as angles and polygons) and their relationships 2. solve real-life and mathematical problems involving angle measure.	In 8th grade, this cluster does not directly connect to any other cluster.	In high school, learners 1. develop a more formal understanding of transformations in the plane 2. prove theorems about triangles, lines, and angles.

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

- Transformation
- Translation
- Translate
- Rotation
- Rotate
- Reflection
- Reflect
- Dilation
- Dilate
- line segment
- Similar
- congruent figures
- Parallel
- Transversal
- exterior angle
- interior angle
- angle-angle criterion
- scale factor
- map

Relevance, Explanations, and Examples:

8.G.1: **NOTE:** “mapped to” can also be stated with “taken to” and/or “carried to” and possibly other phrases

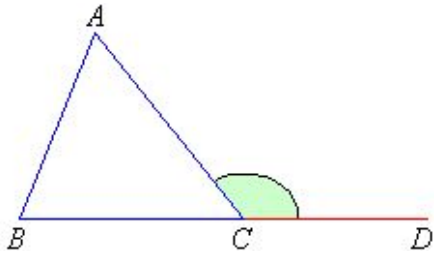
8.G.2: **NOTE:** Translations, reflections, and rotations are called “rigid motions”

8.G.3: Descriptions of coordinate changes when a transformation occurs:

Reflection over *x*-axis	$(x, y) \rightarrow (x, -y)$
Reflection over *y*-axis	$(x, y) \rightarrow (-x, y)$
Translation	$(x, y) \rightarrow (x + a, y + b)$
Dilation	$(x, y) \rightarrow (kx, ky)$
Rotation 90° counterclockwise	$(x, y) \rightarrow (-y, x)$
Rotation 180°	$(x, y) \rightarrow (-x, -y)$

NOTE: The value “k” from the table above is the scale factor for a dilation.

8.G.5: The shaded angle C refers to the exterior angle.



8.G.5: Possible language used for angle relationships formed when a transversal cuts two parallel lines:

- Vertical angles
- Adjacent angles
- Supplementary angles
- Complementary angles
- Alternate interior angles
- Alternate exterior angles
- Corresponding angles
- Same side interior angles (can be referred to as consecutive angles)
- Same side exterior angles (can be referred to as consecutive angles)

Achievement Level Descriptors	
Cluster: **Understand congruence and similarity using physical models, transparencies or geometry software.**	
Concepts and Procedures	***Level 1:*** Students should be able to identify reflections, rotations, and translations and the result of these rigid motions on figures.
	Level 2: Students should be able to construct reflections and translations of figures in a coordinate plane and identify dilations and the results of dilations on figures.
	Level 3: Students should be able to understand and describe the impact of a transformation on a figure and its component parts with or without coordinates.They should be able to use or describe a sequence of transformations to determine or exhibit the congruence of two figures.They should also be able to construct rotations and dilations of figures in a coordinate plane.
	Level 4: Students should be able to describe a sequence that exhibits the similarity between two shapes and understand that the angle measures are unchanged.