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.*

<table>
<tr><td colspan="2">Domain: Geometry</td><td>Grade Level: Geometry</td></tr>
<tr><td colspan="3">G.G.SRT.A Cluster: Understand similarity in terms of similarity transformations

This cluster establishes the basic criteria of similarity through an analysis of dilation transformations. Learners formalize the similarity theorems and use the theorems to prove pairs of triangles are similar.</td></tr>
<tr><td colspan="3">**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.

G.G.SRT.A.1 Verify experimentally and apply the properties of dilations as determined by a center and a scale factor.

G.G.SRT.A.2 Determine whether figures are similar, using the definition of similarity and using similarity transformations.

G.G.SRT.A.3 Use the properties of similarity transformations to establish similarity theorems. Theorems must include AA, SAS, and SSS.</td></tr>
<tr><td colspan="3">Aspects of Rigor: (Conceptual, Procedural, and/or Application)</td></tr>
<tr><td colspan="3">G.G.SRT.A.1 Verify experimentally and apply the properties of dilations as determined by a center and a scale factor.</td></tr>
<tr><td>Conceptual Understanding</td><td>Procedural Fluency</td><td>Application</td></tr>
<tr><td>Understand a dilation enlarges or reduces an image by a specific scale factor and side lengths of the image are multiples of the preimage.

Understand that a dilation preserves the measure of angles from the preimage to the image.</td><td>Perform dilations in a coordinate plane given a preimage, center, and scale factor. For example, dilate the image from a center of (-3,2) by a scale factor of 3.</td><td>Use an image from a contextual situation (family photo, business logo, etc.) that needs to be reduced or enlarged by a given scale factor and perform the dilation.</td></tr>
<tr><td colspan="3">G.G.SRT.A.2 Determine whether figures are similar, using the definition of similarity and using similarity transformations.</td></tr>
<tr><td>Conceptual Understanding</td><td>Procedural Fluency</td><td>Application</td></tr>
<tr><td>Understand the definition of similar as figures having the same shape with congruent angles and proportional side lengths.</td><td>Analyze all pairs of angles and sides of two figures to determine if they are similar.

Identify the sequence of</td><td></td></tr>
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Know that a dilation transformation will result in similar figures.	transformations that shows two figures are similar.	

G.G.SRT.A.3 Use the properties of similarity transformations to establish similarity theorems. Theorems must include AA, SAS, and SSS.

Conceptual Understanding	***Procedural Fluency***	***Application***
Establish similarity theorems by dilating different combinations of given angles and sides of triangles.	Identify the similarity theorem that proves a pair of triangles are similar or determine that they cannot be proven similar. Write a proof to show two triangles are similar.	

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

1. **Make sense of problems and persevere in solving them.**
   - Learners must be challenged to develop deep understanding through exploring a range of tasks that require problem solving.
   - Make sense of formulas and the relationships among them.
2. **Reason abstractly and quantitatively.**
   - Justifying formulas will move learners from concrete to abstract thinking.
   - Learners reason quantitatively about the relationships among the sides of similar figures.
   - Learners will note relationships among the sides and angles of a right triangle in order to reason about their effect on the trigonometric ratios.
   - Use exploration of transformations to develop criteria for proving similarity.
3. **Construct viable arguments and critique the reasoning of others.**
   - Learners will construct informal and formal arguments (proofs) using properties, definitions, and theorems.
   - Learners should have an opportunity to compare their proofs to those created by their classmates (critique the reasoning of others).
   - Learners need to explain their reasoning for the patterns and relationships they find.
4. **Model with mathematics.**
   - Given its particular applicability in real world contexts, modeling is a particular focus throughout this cluster.
   - Solve contextual problems by modeling with right triangles and determine corresponding parts of similar figures when calculating indirect measurements.
   - Select appropriate similarity theorem(s) or trigonometric relationships to apply to a situation.
5. **Use appropriate tools strategically.**
   - Use a variety of tools, including graph paper, tracing paper, and geometry software to explore relationships and lead to general conclusions.
6. **Attend to precision.**
   - Learners use precise mathematical language to express their reasoning, formulate generalizations, and construct arguments.
   - Select appropriate level of precision (exact answer, rounding).
7. **Look for and make use of structure.**
   - Learners identify patterns in tables of values to formulate generalizations about relationships within and between trigonometric ratios.
   - Determine how complementary angles and their trigonometric functions are related.
   - Use auxiliary lines to design solutions and create arguments.
8. **Look for and express regularity in repeated reasoning.**
   - Look for patterns in explorations and apply them to make generalizations.

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***

In 8th grade, learners perform transformations, including dilations, in a coordinate plane. They also identify a sequence of transformations that highlights the similarity of two figures.	In later clusters, learners will use their conceptual understanding of similarity to explore trigonometric relationships including special right triangles and trigonometric ratios.	Learners will continue their work with similar figures in later courses when working with trigonometric ratios and the unit circle. They will use their understanding of dilations when working with functions to determine a stretch/shrink transformation.

Vocabulary (key terms and definitions)

- scale factor
- enlargement
- reduction
- dilation
- center of dilation
- similar

Relevance, Explanations, and Examples:

In 8th grade, learners explore similarity through transformations. In high school, this learning will be expanded to emphasize the relationship between sides and angles to lead to similarity theorems.

Dilations should not be limited to originating from a center of (0,0). Use all quadrants of the coordinate plane.

Dilations should include a process that requires learners to measure the distance from center to the preimage and multiply that distance by the scale factor to find the location of the image.

Achievement Level Descriptors

Cluster: Understand similarity in terms of similarity transformations.

Concepts and Procedures	***Level 1:*** Level 1 students should be able to base arguments on concrete referents such as objects, drawings, diagrams, and actions and identify obvious flawed arguments in familiar contexts.
	Level 2: Level 2 students should be able to find and identify the flaw in an argument by using examples or particular cases. Students should be able to break a familiar argument given in a highly scaffolded situation into cases to determine when the argument does or does not hold.
	Level 3: Level 3 students should be able to use stated assumptions, definitions, and previously established results and examples to test and support their reasoning or to identify, explain, and repair the flaw in an argument. Students should be able to break an argument into cases to determine when the argument does or does not hold.
	Level 4: Level 4 students should be able to use stated assumptions, definitions, and previously established results to support their reasoning or repair and explain the flaw in an argument. They should be able to construct a chain of logic to justify or refute a proposition or conjecture and to determine the conditions under which an argument does or does not apply.