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.CO.B Cluster: Understand congruence in terms of rigid motion Learners create a definition of triangle congruence in terms of rigid motions. They work to develop a set of criteria for triangle congruence and build a foundation for geometric proofs.	

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.CO.B.6 Use geometric descriptions of rigid motions to transform figures.
   a. Predict the effect of a given rigid motion on a given figure.
   b. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G.G.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G.G.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

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

G.G.CO.B.6a Use geometric descriptions of rigid motions to transform figures. a. Predict the effect of a given rigid motion on a given figure.

Conceptual Understanding	Procedural Fluency	Application
Understand that rigid transformations preserve congruence. Predict the orientation and location based on an understanding of rigid transformations.	Create an image from a preimage given the description of a rigid transformation.	

G.G.CO.B.6b Use geometric descriptions of rigid motions to transform figures. b. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

Conceptual Understanding	Procedural Fluency	Application
Show that two figures are congruent by providing a sequence of transformations that maps one onto another.		

G.G.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

Conceptual Understanding	Procedural Fluency	Application
Know that if all six corresponding parts of two triangles are congruent, then there is a series of transformations that maps one onto the other. Know that if there is a series of transformations that maps one triangle onto another, then all six corresponding parts of the triangles are congruent.		

G.G.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Conceptual Understanding	Procedural Fluency	Application
Show there are specific sets of congruent parts that triangles may have that ensures they are congruent.	Prove triangles congruent using ASA, SAS, and SSS.	

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 of the ideas in the clusters through exploring tasks that require problem solving.
   - As learners reason and experiment with rigid motions, determining a correct sequence of transformations will require perseverance.
2. **Reason abstractly and quantitatively.**
3. **Construct viable arguments and critique the reasoning of others.**
   - Learners should be encouraged to form arguments explaining why certain patterns hold in transformations and constructions, and to critique arguments that are presented to them.
   - In addition to creating proofs (constructing viable arguments), learners should have an opportunity to compare their proofs to those created by their classmates (critique the reasoning of others).
4. **Model with mathematics.**
   - Learners will apply ideas about transformations to model real-world contexts.
5. **Use appropriate tools strategically.**
   - Learners should use a variety of tools constructions and transformations, including compass and straightedge, graph paper, tracing paper, or geometry software.
   - The use of a variety of tools will be useful in making generalizations and proofs about when two triangles will be congruent.
6. **Attend to precision.**
   - While appearances might lead learners to certain conclusions, they need to precisely describe the transformations that they use and ensure that they work as they thought.
   - Learners need to use precise mathematical language to thoroughly explain the reasoning behind their work and when formalizing definitions.
   - Precision is of crucial importance in constructions, since even small errors in executing a construction may lead to results that don't work.
   - Use precise geometric language within proofs.
7. **Look for and make use of structure.**
   - Learners should look for patterns in their explorations, leading them to making generalizations about the transformations and constructions.
   - Looking for structure is an important aspect of conjecturing.

8. **Look for and express regularity in repeated reasoning.**
   - Looking for patterns is an important aspect of conjecturing.
   - Learners will need to look for patterns that will help them see general methods for constructions that can be used.

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	*Current Learning Connections*	*Future Learning Connections*
In 7th grade, learners focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. In 8th grade, learners develop understanding of congruence using physical models, transparencies, or geometry software. Learners also understand that figures are congruent if the second can be obtained from the first by a sequence of rotations, reflections, and/or translations.	Learners will use triangle congruence concepts to develop future postulates and theorems. Concepts of triangle congruence serve to build a foundation for work with triangle proofs in future clusters.	In later courses, learners consider triangle congruence and the ambiguous case when working with the Law of Sines and Law of Cosines.

Vocabulary (key terms and definitions)

- congruence
- corresponding Parts
- Side-Side-Side Congruence (SSS)
- Side-Angle-Side Congruence (SAS)
- Angle-Side-Angle Congruence (ASA)
- included Angle
- included Side
- congruent figures

Relevance, Explanations, and Examples:

Angle-Angle-Side can be considered as a special case of Angle-Side-Angle, thus is not listed separately.

Ambiguous case should be included during exploration when defining the specific sets of criteria that proves congruence. Consider including Hypotenuse-Leg as a special case of the ambiguous case.

This is an opportunity to introduce learners to formal proofs. This includes the structure and precise notation needed to communicate geometrically.

Expect learners to be able to explain their reasoning for identifying a specific triangle congruence theorem.

Achievement Level Descriptors

Cluster: Understand congruence in terms of rigid motion

Concepts and Procedures	**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: 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: 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: 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.