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: 8th

8.G.B Cluster: Understand and apply the Pythagorean Theorem.

Explore the relationships between sides of a right triangle to understand the formula $a^2 + b^2 = c^2$. Solve problems applying the Pythagorean Theorem.

**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.6. Explain a proof of the Pythagorean Theorem and its converse.

8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and problems in two and three dimensions.

8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

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

Conceptual Understanding	*Procedural Fluency*	*Application*
Understand that in a right triangle, the sum of the squares of the legs equals the square of the hypotenuse. ($a^2 + b^2 = c^2$: *a* and *b* are legs, *c* is hypotenuse) **(8.G.6)** Understand that when the sum of the squares of the two short sides of a triangle equals the square of the largest side of a triangle, that triangle is a right triangle. **(8.G.6)**		
	Identify the given side lengths of a right triangle as a leg or hypotenuse. **(8.G.7)** Find the missing side length of a right triangle in two and three dimensions. **(8.G.7)**	Apply the Pythagorean Theorem to a real-world problem to find a missing side length. Ex: Find the diagonal of a pet cage. Find the diagonal of a TV. **(8.G.7)**
Understand that between any two points in a coordinate system, a right triangle can be constructed. **(8.G.8)**	Find the hypotenuse of a right triangle in a coordinate system. **(8.G.8)**	

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.**
   - Explain the relationship between the area of a square and the length of its side (square root).
3. **Construct viable arguments and critique the reasoning of others.**
   - Model an informal proof to understand the Pythagorean Theorem.
4. **Model with mathematics.**
   - Find the side lengths to determine the measurements of realistic two and three-dimensional problems.
5. **Use appropriate tools strategically.**
   - Model the proof of the Pythagorean Theorem through technology, construction paper, and/or graph paper.
6. **Attend to precision.**
   - Calculate the measurement of the side length with the context of the problem in mind (ex: find side length of square, keep as square root; find side length of house, approximate the answer).
7. **Look for and make use of structure.**
   - Use the Pythagorean Theorem to find the missing side lengths of right triangles, distances between points in a coordinate plane, and to find the length of a diagonal in a rectangular prism.
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 6th grade, learners 1. graph points in a coordinate system 2. find the horizontal or vertical distance between two points in a coordinate system 3. draw polygons in a coordinate system when given vertices. In 7th grade, learners 1. find the area of squares.	In 8th grade, learners 1. use square root symbols to represent solutions. 2. approximate square root values.	In high school, learners 1. prove theorems about triangles. 2. use Pythagorean Theorem to solve problems and discover other mathematical relationships.

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

- Pythagorean Theorem
- Converse
- Square
- Leg
- Hypotenuse
- Right triangle
- Square Root

Relevance, Explanations, and Examples:

8.G.6.
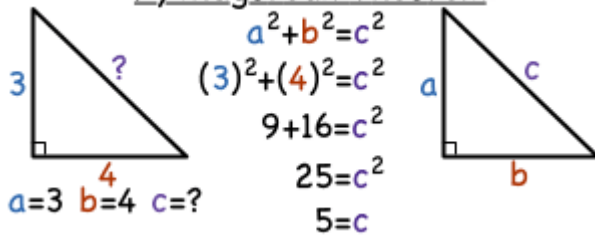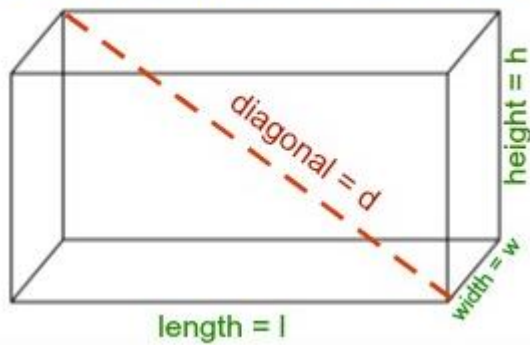Pythagorean Theorem
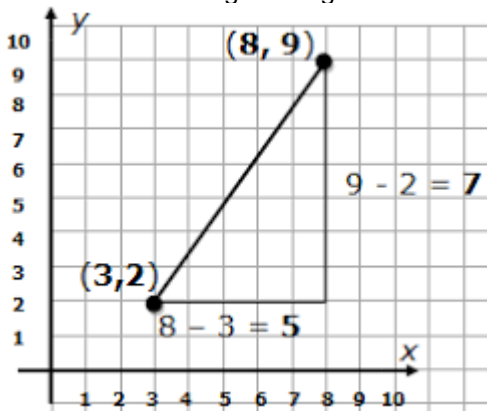$a^2 + b^2 = c^2$
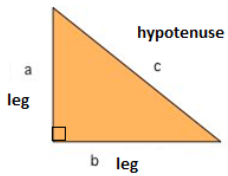
8.G.7.

Two-Dimensional

Pythagorean Theorem:
$$a^2+b^2=c^2$$
$$(3)^2+(4)^2=c^2$$
$$9+16=c^2$$
$$25=c^2$$
$$5=c$$

a=3 b=4 c=?

Three-Dimensional

8.G.8
Construction of a right triangle in a coordinate system

Cluster: Understand and apply the Pythagorean Theorem.	
Concepts and Procedures	**Level 1:** Students should be able to identify the hypotenuse and the legs of a right triangle given the side lengths or an image of a right triangle.
	Level 2: Students should be able to apply the Pythagorean theorem to determine whether or not a given triangle is a right triangle,given its side lengths.They should be able to find the distance between two points on a horizontal or vertical line in a two-dimensional coordinate system.
	Level 3: Students should be able to apply the Pythagorean theorem to determine the unknown side lengths of right triangles and to find the distance between two points in a coordinate system in two dimensions.
	Level 4: Students should be able to apply the Pythagorean theorem to find the distance between two points in a coordinate system in three dimensions.