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: Functions		**Grade Level: Algebra 2**
A2.F.TF.C Cluster: Prove and apply trigonometric identities. *Learners will make connections between their knowledge of the Pythagorean Theorem, trigonometric ratios, the unit circle and coordinate plane.*		
****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.* **A2.F.TF.C.8 Prove the Pythagorean identity $\sin^2(A) + \cos^2(A) = 1$ and use it to calculate trigonometric ratios.**		
Aspects of Rigor for Students: (Conceptual, Procedural, and/or Application)		
A2.F.TF.C.8 ***Prove the Pythagorean identity $\sin^2(A) + \cos^2(A) = 1$ and use it to calculate trigonometric ratios.***		
Conceptual Understanding	***Procedural Fluency***	***Application***
Learners can explain how to prove the Pythagorean identity.	Learners will be able to use the concepts from the Pythagorean identity to calculate trigonometric ratios in any quadrant on the coordinate plane.	
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.** ● Students will be able to prove the Pythagorean Identity. 4. **Model with mathematics.** 5. **Use appropriate tools strategically.** ● Students are able to use an appropriate method to calculate trig ratios in all quadrants. 6. **Attend to precision.** ● Students can determine whether a trigonometric ratio should be positive or negative based on the information given (such as quadrant or other restrictions). 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 Geometry, students learn the relationship of trigonometric ratios. In 8th grade, Algebra 1, and Geometry, students also learn the Pythagorean Theorem and how to graph on a coordinate plane	*Students will use their knowledge of the unit circle and relate that to determine trigonometric ratios not on the unit circle.*	*In Precalculus and Calculus courses, students will connect this learning cluster to other trigonometric ratios (tangent, cosecant, secant and cotangent).*

Vocabulary (key terms and definitions)

- Pythagorean Identity

Relevance, Explanations, and Examples:

Explaining the proof for the Pythagorean identity is the heart of this cluster, then students can solve problems that involve this identity in a variety of ways (depending on their preference). Here's an example of two ways to solve this problem:

$\cos\theta = \frac{3}{5}$ and θ is in quadrant 4, find $\tan\theta$.

Method 1:

$\sin^2\theta + \cos^2\theta = 1$

$\sin^2\theta + \left(\frac{3}{5}\right)^2 = 1$

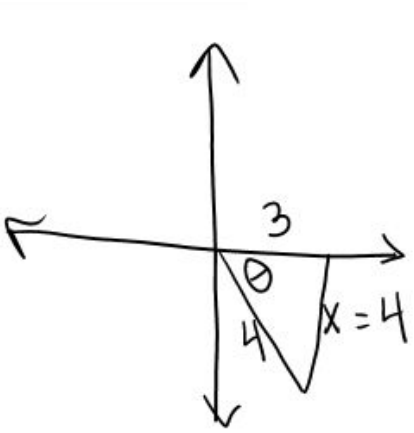
$\sin^2\theta = 1 - \frac{9}{25}$

$\sqrt{\sin^2\theta} = \sqrt{\frac{16}{25}}$

$\sin\theta = \frac{-4}{5}$ — negative because in Q4

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{-4/5}{3/5} = -\frac{4}{3}$

Method 2:



$3^2 + x^2 = 5^2$

$9 + x^2 = 25$

$x^2 = 16$

$x = 4$

$\tan\theta = \frac{opp}{adj} = \frac{-4}{3}$

⇓

negative because tan is negative in QH.

Achievement Level Descriptors	
Cluster: Prove and apply trigonometric identities.	
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.