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.*

Domain: Geometry	**Grade Level: 4th Year**
HS4.G.GPE.A Cluster: Translate between the geometric description and the equation for a conic section. Students will be able to recognize conic types from the general equation, be able to move between general and standard form of the equation, and be able to graph without technology.	
In a precalculus class 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.GPE.3** Analyze conic sections using equations and graphs. **a**. Given a quadratic equation of the form $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ (where B = 0), determine whether the graph is a circle, parabola, ellipse, or hyperbola **b.** Use the process of completing the square to put the equation in standard form **c.** When given a graph, be able to write the equation of the conic section, and vice versa.	
Aspects of Rigor of Student Learning: (Conceptual, Procedural, and/or Application)	
G.GPE.3 Analyze conic sections using equations and graphs. **a**. Given a quadratic equation of the form $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ (where B = 0), determine whether the graph is a circle, parabola, ellipse, or hyperbola **b.** Use the process of completing the square to put the equation in standard form **c.** When given a graph, be able to write the equation of the conic section, and vice versa.	

Conceptual Understanding	***Procedural Fluency***	***Application***
	Students determine whether a conic equation represents a circle, parabola, ellipse or hyperbola. Students will write equations of circles, parabolas, ellipses, and hyperbolas in standard form. Students will graph a conic given an equation in standard form.	Conics can be used to model and solve many types of real-life problems.

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.**
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
    - Students could use dynamic geometry software to explore possible relationships.
6. **Attend to precision.**
7. **Look for and make use of structure.**

- Students explore patterns and consider the structure of relationships within the coordinate plane in order to form generalizations.

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***
Students have worked with parabolas in Algebra I and II and circles in Geometry. Students have worked with the distance formula in Geometry and have learned how to complete the square in Algebra II.	Students will be able to recognize conic types from the general equation, be able to move between general and standard form of the equation, and be able to graph without technology.	Students will use conic sections in Calculus to explore three dimensional surfaces such as hyperbolic paraboloids.

Vocabulary (key terms and definitions)

- Conic section
- Parabola
- Ellipse
- Hyperbola
- Center
- Major Axis
- Minor Axis
- Vertex
- Transverse axis
- Asymptotes
- General form
- Standard form

Relevance, Explanations, and Examples:

Example of Standard Form for a Parabola

$4p(y-k)=(x-h)^2$ *or* $4p(x-h)=(y-k)^2$

The vertex is located at (h,k) and the value of p is the directed distance from the vertex to the focus. If p is (-) then the parabola opens down or left. If p is (+) then the parabola opens up or right.

Example of General Form for a Parabola

$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ (where B = 0 and C = 0 or B = 0 and A = 0)