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: Statistics and Probability	**Grade Level: Geometry**

G.S.CP.B Cluster: Use the rules of probability to compute probabilities of compound events in a uniform probability model.

The development and uses of algorithms are built on conceptual understanding as concepts of sample spaces are explored and deepend. Probabilities are described in terms of the intersections and unions of events. Venn diagrams and two-way frequency tables will be generalized to discover patterns and create algorithms and formulas that can be used in routine fashion. Although learners will use these formulas strategically to determine different values, the use of tree diagrams, organized lists, and other tools will help make sense of these abstractions.

****This is an ADDITIONAL 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.S.CP.B.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the result.

G.S.CP.B.7 Apply the Addition Rule, P(A or B), and interpret the result.

G.S.CP.B.8 (+) Apply the general Multiplication Rule, P(A and B), and interpret the result.

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

G.S.CP.B.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the result.

Conceptual Understanding	***Procedural Fluency***	***Application***
Conditional probability can be calculated from a reduced sample space (subset). This leads to the formula for conditional probability.	Calculate conditional probability using a reduced sample space or a formula. Symbolize events and use probability notations to define operations.	The Monty Hall problem is a classic example with a non-intuitive result.

G.S.CP.B.7 Apply the Addition Rule, P(A or B), and interpret the result.

Conceptual Understanding	***Procedural Fluency***	***Application***
The probability of two events can be calculated by mathematically combining their separate probabilities.	Calculate the probability of the union of two events (either mutually exclusive or inclusive) using a formula or a diagram.	Multiple bets on a roulette wheel improves chances of winning.

G.S.CP.B.8 (+) Apply the general Multiplication Rule, P(A and B), and interpret the result.

Conceptual Understanding	***Procedural Fluency***	***Application***
The probability of two events can be calculated by mathematically combining their separate probabilities. When events are dependent, conditional probability must be used in the Multiplication Rule.	Calculate the probability of the intersection of two events using a formula or a diagram.	Biology (Recessive genes) What is the probability of both parents passing on a recessive gene?

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.
   - Use formulas strategically in calculations.
3. **Construct viable arguments and critique the reasoning of others.**
   - Learners justify their process for solutions and connect ideas of independence and disjoint sets.
4. **Model with mathematics.**
   - Learners may model problems and look for structure with Venn diagrams, tables, or other methods in order to solve problems and make generalizations.
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
   - Through precise descriptions, learners attend to problem contexts and ensure the appropriate interpretation of results.
   - Precisely use set notation to describe compound and conditional probability.
7. **Look for and make use of structure.**
   - Learners focus on the differences and similarities of different sets' relationships.
   - Learners attend to the structure of the set, definitions, and solutions to verify the results of the relationship and notations of the questions.
   - Learners use structure of different representations including Venn Diagrams and tables to develop rules.
8. **Look for and express regularity in repeated reasoning.**.
   - Learners develop formulas for the Addition Rule and Multiplication Rule through the exploration of probability relationships.

Vertical and Horizontal Coherence and Learning Progressions

Previous Learning Connections	***Current Learning Connections***	***Future Learning Connections***
In grade 7, learners have investigated chance processes, and developed, used, and evaluated probability models. They have learned that probability of a chance event is a number between 0 and 1 **(7.SP.5)** and found probabilities of compound	Learners are expanding their understanding and skills explored and learned in the **G.SP.A** cluster. They are discovering that conditional probability can be found from a narrowed subset of the original sample space.	Future learning such as binomial distribution and statistical significance build upon conditional probability. Other applications are found in calculus, statistics, engineering, and the sciences. Many careers including actuaries, industrial engineers,

events **(7.SP.8)**.		statisticians, and production managers will frequently use statistics concepts including conditional probability.

Vocabulary (key terms and definitions)

- addition rule of probability
- multiplication rule of probability

Relevance, Explanations, and Examples:

Venn Diagrams, tree diagrams, and two-way frequency tables are helpful as learners generalize these concepts.

Using visual representations such as Venn diagrams and frequency distributions is helpful to focus learners' attention on the "double counting" of events when using inclusive probability models. (i.e. probability of a given card is a heart or a king) The same strategies can be used to focus attention on conditional probability as the proportion within a subset of the data.

A solid understanding of G.SP.A is necessary for learners to understand the formulas developed in this cluster. Learners can then relate these general rules to previously learned rules for independent events and disjoint sets.

Make connections across multiple representations and allow the learners to develop rules and formulas with a goal of conceptual understanding. Learning a rule in order to perform an algorithm is not the intention of this standard.

Achievement Level Descriptors

Cluster: **Use the rules of probability to compute probabilities of compound events in a uniform probability model.**

Concepts and Procedures	***Level 1:***
	Level 2:
	Level 3:
	Level 4: