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: 7th**

7.SP.C Cluster: Investigate chance processes and develop, use and evaluate probability models.

This cluster focuses on probability and is the first time students encounter this topic formally. Students learn the likelihood of chance events and approximate probabilities. They investigate chance using probability models they develop. The cluster begins with single events and builds up to finding the probability of compound events using tree diagrams, lists, tables, and simulations.

****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.*

7.SP.5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

7.SP.6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

7.SP.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

- **a.** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.
- **b.** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning coin will land heads up or that a tossed paper cup will land open-end down. Do the outcomes from the spinning penny appear to be equally likely based on the observed frequencies?

7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- **a.** Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- **b.** Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
- **c.** Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

Aspects of Rigor for Student Learning: (Conceptual, Procedural, and/or Application)		
Conceptual Understanding	***Procedural Fluency***	***Application***
The likelihood of a chance event can range from 0 to 1. A probability closer to 0 models an unlikely chance event, whereas a probability closer to 1 models a likely chance event. **(7.SP.5)** The sum of the chance event and its complement is 1. **(7.SP.5)** Recognize that the probability of any single event can be expressed with the terms impossible, unlikely, equally likely, likely, or certain. An impossible event has a probability of 0 and a certain event has a probability of 1. **(7.SP.5)** Probability can be expressed as a fraction, decimal or percent. **(7.SP.5)**		
Collect data on chance events (hands-on events such as spinning a spinner and simulations) and approximate the relative frequency of an event given the probability. **(7.SP.6),** Students recognize that as the number of trials increase, the relative frequency (experimental) approaches the probability (theoretical). **(7.SP.6)** Explain the difference between relative frequency (experimental) and theoretical probability using appropriate language.**(7.SP.6)** The relative frequency is the observed number of successful events for a finite sample of trials. **(7.SP.6)** **Note**: The focus of this standard is relative frequency.	Calculate theoretical probability and relative frequency (experimental). **(7.SP.6)** Determine the sample space for a probability model **(7.SP.6)** Note: What in the past has been identified as experimental probability will now be called relative frequency. **(7.SP.6)**	
Students recognize an appropriate design to conduct an experiment with simple probability events, understanding that the experimental data give realistic estimates of the probability of an event but are affected by sample size. **(7.SP.7)** Students recognize that discrepancies between theoretical probability and relative frequency do not necessarily indicate error/inaccuracy. **(7.SP.7)**	Use probability models to find probabilities of events. (7.SP.C.7) Calculate the probability of a (simple) event as a fraction, decimal, or percent. **(7.SP.7)** Determine the probability of events by developing uniform and non-uniform probability models (theoretical probability). **(7.SP.7a and b)** Develop models for geometric	Compare the models to the observed frequency and explain their reasoning for any discrepancies between the model and the observed frequency using appropriate vocabulary. **(7.SP.7)** Students make predictions about the outcomes of an experiment by applying the principles of theoretical probability. They then perform the experiment, comparing their predictions to the outcomes of the

Students develop their understanding of probability by making predictions, comparing the predictions, replicating experiments, and comparing results. **(7.SP.7)**	probability (for example targets). **(7.SP.7)**	experiment, and possibly repeat the experiment to compare results. **(7.SP.7)**
Understand similarities and differences between compound events and simple events. **(7.SP.8)** Understand that the number of possible outcomes for a compound event is determined by multiplying (rather than adding) the number of outcomes for each individual event. **(7.SP.8**)	Find the sample space of a compound event. **(7.SP.8)** Create organized lists, tables, tree diagrams, and simulations to find the probability of a compound event. **(7.SP.8)** Represent the probability of a compound event as a fraction, decimal, or percent. **(7.SP.8)**	Design and use a simulation (using a random number table, calculator, dice, cards, or other manipulatives) to generate frequencies of compound events. **(7.SP.8)** Students can justify their selection of a particular situation, explain how it models a compound event, and describe how the probability was approximated.**(7.SP.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.**
    - Students use reasoning to determine the likelihood of an event.
3. **Construct viable arguments and critique the reasoning of others.**
    - Students can justify their selection of a particular situation.
4. **Model with mathematics.**
    - Students construct and use probability models for chance events.
5. **Use appropriate tools strategically.**
    - Students select from tree diagrams, organized lists, tables, and simulations to determine probabilities.
6. **Attend to precision.**
    - Students calculate probabilities.
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 6th grade, learners approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. In 6th grade, learners use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	In 7th grade, learners will recognize and represent proportional relationships between quantities. In 7th grade, learners will use proportional relationships to solve multistep ratio and percent problems. In 7th grade, learners will solve real world problems using the four operations with rational numbers. In 7th grade, learners will use the formula for area of a circle and solve real-world problems involving area.	In 8th grade, learners construct and interpret a two-way table summarizing data on two categorical variables collected from the same subject. In high school, learners recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. In high school, learners find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of the model.

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

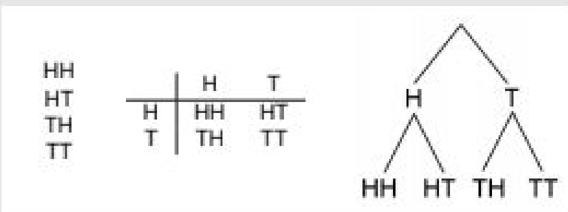
- Probability
- Event
- Chance event
- Likelihood
- Outcome
- Probability model
- Uniform probability model
- Sample space
- Simple event
- Compound events
- Tree diagram
- Simulation
- Complement
- Variability
- Theoretical probability
- Relative frequency

Relevance, Explanations, and Examples:

Note: Students can conduct experiments using a variety of random generation devices, such as bag pulls, spinners, number cubes, coin toss, and colored chips. Students can collect data using physical objects, graphing calculator or web-based simulations.

7.SP.6 & 8

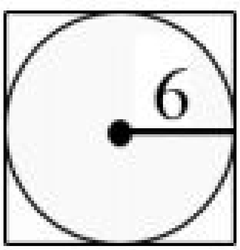
Different representations of a sample space



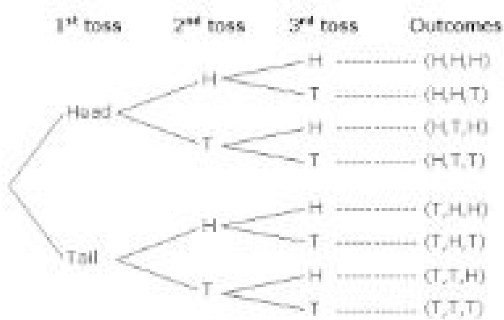
All the possible outcomes of the toss of two coins can be represented as an organized list, table, or tree diagram. The sample space becomes a probability model when a probability for each simple event is specified.

7.SP.7

If Mary chooses a point in the square, what is the probability that it is not in the circle?



7.SP.8



Achievement Level Descriptors

Cluster: **Investigate chance processes and develop, use and evaluate probability models.**

Concepts and Procedures	***Level 1:*** Level 1 students should be able to determine the theoretical probability of a simple event; understand that probabilities are numbers between 0 (impossible) and 1 (always) and that a probability around 1/2 indicates an event that is neither likely nor unlikely.
	Level 2: Level 2 students should be able to approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency. They should be able to predict the approximate relative frequency given the probability.
	Level 3: Level 3 students should be able to find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. They should be able to compare theoretical and experimental results from a probability experiment.
	Level 4: Level 4 students should be able to design, describe, and construct a simulation experiment to generate frequencies for compound events. They should be able to explain what might account for differences between theoretical and experimental results and evaluate the associated probability model.