

# 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.

<b>Domain: Statistics and Probability</b>		<b>Grade Level: 12</b>
<b>HS4.S.MD.B Cluster: Use probability to evaluate outcomes of decisions.</b>		
<i>Students will analyze and recommend decisions based on expected value, randomization, and probability concepts.</i>		
<p><b>This is a MAJOR cluster.</b>  <i>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.</i></p> <p><b>S.MD.5</b> Weigh the possible outcomes of a decision by assigning probabilities to payoff values and calculating the expected values.  <b>a.</b> Calculate the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.  <b>b.</b> Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</p> <p><b>S.MD.6</b> Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).  <b>S.MD.7</b> Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).</p>		
<b>Aspects of Rigor for Student Learning:</b> (Conceptual, Procedural, and/or Application)		
<p><b>S.MD.5</b> Weigh the possible outcomes of a decision by assigning probabilities to payoff values and calculating the expected values.  <b>a.</b> Calculate the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.  <b>b.</b> Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</p>		
<b>Conceptual Understanding</b>	<b>Procedural Fluency</b>	<b>Application</b>
Students connect expected value, expected payoff, and fair price.	<p>Students assign probabilities to payoff values.</p> <p>Students compute expected value to determine fair price or expected payoff.</p> <p>Students compare expected values to make a decision.</p>	Students evaluate and compare strategies using expected value.
<b>S.MD.6</b> Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).		
<b>Conceptual Understanding</b>	<b>Procedural Fluency</b>	<b>Application</b>

Students can explain how randomization can be used to make fair decisions.	Students can identify randomization strategies that can be used to make fair decisions.	Given a situation, students can utilize at least one appropriate randomization strategy that could be used to make a fair decision.
<b>S.MD.7</b> Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).		
<b>Conceptual Understanding</b>	<b>Procedural Fluency</b>	<b>Application</b>
<p>Students relate probability concepts and statistical methods.</p> <p>Students critically review uses of statistics. Students consider study design, how the data were gathered, and the analyses employed to critique the data summaries and the conclusions drawn.</p>		<p>Students analyze decisions and strategies for more complex, real-world scenarios such as product testing, medical testing, and sports strategies using appropriate probability concepts.</p> <p>This is the culminating standard for making decisions with probability and statistics.</p>
<b>Enacting the Mathematical Practices - Evidence of Students Engaging in the Practices</b>		
<ol style="list-style-type: none"> <li>1. <b>Make sense of problems and persevere in solving them.</b> <ul style="list-style-type: none"> <li>• Students make decisions using probability concepts.</li> </ul> </li> <li>2. <b>Reason abstractly and quantitatively.</b></li> <li>3. <b>Construct viable arguments and critique the reasoning of others.</b> <ul style="list-style-type: none"> <li>• Students select, justify, and analyze probability-informed decisions.</li> </ul> </li> <li>4. <b>Model with mathematics.</b> <ul style="list-style-type: none"> <li>• Students apply probability concepts to model situations.</li> </ul> </li> <li>5. <b>Use appropriate tools strategically.</b> <ul style="list-style-type: none"> <li>• Students recognize situations where randomization is useful. Students identify when expected value can inform a decision.</li> </ul> </li> <li>6. <b>Attend to precision.</b></li> <li>7. <b>Look for and make use of structure.</b></li> <li>8. <b>Look for and express regularity in repeated reasoning.</b></li> </ol>		
<b>Vertical and Horizontal Coherence and Learning Progressions</b>		
<b>Previous Learning Connections</b>	<b>Current Learning Connections</b>	<b>Future Learning Connections</b>
<p>In seventh grade, students investigate chance processes to develop, use and evaluate probability models. Students understand the probability closer to 1 (1.0 or 100%) equates to more of a likelihood an event will occur. Students calculate theoretical probability and relative frequency, and determine sample space. Students also develop an understanding that probability can be used to make predictions and develop an understanding of the similarities and differences between compound and simple events.</p> <p>In high school algebra 2 students</p>	<p>In this course students will calculate expected value of a random variable, make predictions using theoretical probability and empirical data. Students will use rules such as t-test, z-score and binomial distributions to compute probability of compound events.</p>	<p>Students will build on this knowledge in subsequent statistics courses. These standards relate to work done by analysts and actuaries, as well as in personal finance decisions.</p>

learn and understand random samples to represent the population to avoid statistical bias, and understand the difference between rare and ordinary events. Also in algebra 2 students learn the differences between sample surveys, experiments and observational studies, and how to make conclusions from each.

***Vocabulary (key terms and definitions)***

Fair price  
Expected payoff  
Randomization

***Relevance, Explanations, and Examples:***