

**Math III UNIT 1 OVERVIEW: Modeling with Statistics**

<b>Unit Outcomes</b> At the end of this unit, your student should be able to:	<b>Key Vocabulary</b> Terms to deepen the student's understanding
<ul style="list-style-type: none"> <li>✓ Describe the characteristics of a standard normal curve.</li> <li>✓ Use the mean and standard deviation of a data set to fit it to a normal distribution.</li> <li>✓ Estimate population percentages based on a normal distribution with given mean and standard deviation.               <ul style="list-style-type: none"> <li>• Apply the Empirical Rule to estimate probabilities for normal distributions.</li> <li>• Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</li> </ul> </li> <li>✓ Calculate a z-statistic (z-score) and explain its meaning in context.</li> <li>✓ Describe types of data sets for which it is not appropriate to fit a normal distribution.</li> <li>✓ Explain the purposes of and differences among sample surveys, experiments, and observational studies.</li> <li>✓ Explain how randomization relates to sample surveys, experiments, and observational studies.</li> <li>✓ Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</li> <li>✓ Identify and describe types of bias that might be present in a data collection process.</li> <li>✓ Write appropriate, non-biased survey questions to gather data.</li> <li>✓ Compare different types of sampling (simple random, systematic, convenience, cluster, stratified) and describe circumstances for when it is most appropriate to use each type.</li> <li>✓ Use data from a sample survey to estimate a population mean or proportion.</li> <li>✓ Explain the difference between a population parameter and a sample statistic.</li> <li>✓ Develop a margin of error through the use of simulation models for random sampling.</li> <li>✓ Determine a sample size given a set margin of error.</li> <li>✓ Use data from a randomized experiment to compare two treatments.</li> <li>✓ Use simulations to decide if differences between parameters are significant.</li> <li>✓ Use a random number table or random number generator on a calculator for a randomized selection process.</li> <li>✓ Evaluate reports based on data.</li> <li>✓ Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).</li> <li>✓ Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).</li> </ul>	<ul style="list-style-type: none"> <li>✓ Normal distribution</li> <li>✓ Empirical Rule</li> <li>✓ Standard normal curve</li> <li>✓ Z-statistic</li> <li>✓ Simple random sample (SRS)</li> <li>✓ Stratified sample</li> <li>✓ Cluster sample</li> <li>✓ Systematic random sample</li> <li>✓ Convenience Sample</li> <li>✓ Survey</li> <li>✓ Observational Study</li> <li>✓ Experiment</li> <li>✓ Bias</li> <li>✓ Undercoverage</li> <li>✓ Voluntary response bias</li> <li>✓ Nonresponse bias</li> <li>✓ Lurking variables</li> <li>✓ Parameter</li> <li>✓ Statistic</li> <li>✓ Sample proportion</li> <li>✓ Inference</li> <li>✓ Margin of error</li> <li>✓ Random number generator</li> <li>✓ Simulation</li> <li>✓ Expected Value</li> <li>✓ Fair game</li> </ul>

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- ✓ Apply probability concepts to real life situations.
- ✓ Calculate the expected value of a probability simulation.
- ✓ Determine whether a game is fair.

<p align="center"><b>Key Standards Addressed</b></p> <p align="center">Connections to Common Core/NC Essential Standards</p>	<p align="center"><b>Where This Unit Fits</b></p> <p align="center">Connections to prior and future learning</p>
<p><b>S-ID.4</b> Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p> <p><b>S-IC.1</b> Understand statistics as a process for making inferences about population parameters based on a random sample from that population. Make inferences and justify conclusions from sample surveys, experiments, and observational studies</p> <p><b>S-IC.3</b> Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p> <p><b>S-IC.4</b> Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p> <p><b>S-IC.5</b> Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.</p> <p><b>S-IC.6</b> Evaluate reports based on data.</p>	<p><b>Coming into this unit, students should have a strong foundation in:</b></p> <ul style="list-style-type: none"> <li>✓ The concept of statistical variability</li> <li>✓ Understanding the difference between categorical and quantitative data</li> <li>✓ Summarizing and describing a set of data both numerically and graphically</li> <li>✓ The concept of using random sampling to draw inferences about a population</li> <li>✓ Drawing informal comparative inferences about two populations</li> <li>✓ Probability concepts</li> </ul> <p><b>This unit builds to the following future skills and concepts:</b></p> <p><u>From the College Board AP Statistics Course Description:</u></p> <ul style="list-style-type: none"> <li>✓ Exploring Data: Describing patterns and departures from patterns <ul style="list-style-type: none"> <li>• Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. Emphasis should be placed on interpreting information from graphical and numerical displays and summaries.</li> </ul> </li> <li>✓ Sampling and Experimentation: Planning and conducting a study <ul style="list-style-type: none"> <li>• Data must be collected according to a well-developed plan if valid information on a conjecture is to be obtained. This plan includes clarifying the question and deciding upon a method of data collection and analysis.</li> </ul> </li> <li>✓ Anticipating Patterns: Exploring random phenomena using probability and simulation <ul style="list-style-type: none"> <li>• Probability is the tool used for anticipating what the distribution</li> </ul> </li> </ul>

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<p><b>S-MD.6 (+)</b> Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).</p> <p><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>	<p>of data should look like under a given model.</p> <ul style="list-style-type: none"> <li>✓ Statistical Inference: Estimating population parameters and testing hypotheses             <ul style="list-style-type: none"> <li>• Statistical inference guides the selection of appropriate models.</li> </ul> </li> </ul>
<p><b>Additional Resources</b> Materials to support understanding and enrichment</p>	
<ul style="list-style-type: none"> <li>✓ <a href="#">The Normal Distribution</a></li> <li>✓ <a href="#">The Normal Distribution Study Quiz</a></li> <li>✓ <a href="#">Survey Sampling Methods</a></li> <li>✓ <a href="#">Bias</a></li> <li>✓ <a href="#">Parameter v. Statistic</a></li> <li>✓ <a href="#">Margin of Error</a></li> <li>✓ <a href="#">Simulation of Sampling Distribution</a></li> <li>✓ <a href="#">Sampling Practice Quiz</a></li> <li>✓ <a href="#">Sampling Strategies Quiz</a></li> <li>✓ <a href="#">Random Digit Table “How to”</a></li> <li>✓ <a href="#">Expected Value</a></li> <li>✓ <a href="#">Expected Values &amp; Simulation</a></li> <li>✓ <a href="#">A Lesson in Probability</a></li> </ul>	

\* **Please note**, the unit guides are a work in progress. If you have feedback or suggestions on improvement, please feel free to contact [sdupree@wcpss.net](mailto:sdupree@wcpss.net).