# Seymour Public Schools Curriculum

The Mathematics Department believes its students must learn the importance of mathematics, the integration of different branches of mathematics, the application of math to real-life problems, and the connections between mathematics and other disciplines. This course is concerned with developing the students' understanding of the concepts of trigonometry and providing experience with its methods and applications in order to prepare students for study of higher mathematics.

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| **Grade:** 11-12 | **Statistics**<br><br>**Introduction to Statistics** |
| **Common Core Standards** | S-IC Making Inferences and Justifying Conclusions |
| **Enduring Understanding** | Statistics allow inferences about a population to be made |
| **Essential Questions** | What is the purpose of statistics?<br>How do we obtain samples to be a representation of a population?<br>What are some of the problems that are experienced when sampling and how can they be corrected?<br>How do we design an experiment? |
| **Content Standards:** | **Understand and evaluate random processes underlying statistical experiments**<br>S-IC-1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.<br>S-IC-2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*<br><br>**Make inferences and justify conclusions from sample surveys, experiments, and observational studies** |

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| | S-IC-3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. |
| **Performance Expectations (Student outcomes)** | At the completion of this unit, students will be able to:<br>• distinguish between a population and a sample.<br>• distinguish between a parameter and a statistic.<br>• distinguish between descriptive and inferential statistics.<br>• distinguish between qualitative and quantitative data.<br>• classify data with respect to the four levels of measurement (nominal, ordinal, interval, ratio).<br>• know how data are collected (observational study, survey, experiment, simulation).<br>• design an experiment.<br>• create a sample using random sampling, simple random sampling, stratified sampling, cluster sampling, and systematic sampling.<br>• identify a biased sample. |

| **Strategies/Modes (examples)** | **Materials/Resources (examples)** | **Assessments (examples)** |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 1 (1.1 – 1.3) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |

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| **Grade:** 11-12 | **Statistics**<br><br>**Descriptive Statistics** |
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| **Common Core Standard** | S-ID Interpreting Categorical and Quantitative Data |
| **Enduring Understanding** | Data needs to be presented appropriately in order to provide meaning. |
| **Essential Questions** | How is data organized and summarized?<br>How can data be described graphically and by means of numerical quantities? |
| **Content Standards:** | **Summarize, represent, and interpret data on a single count or measurement variable**<br>S-ID-1 Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>S-ID-2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>S-ID-3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). |
| **Performance Expectations (Student outcomes)** | At the completion of this unit, students will be able to:<br><br>• construct a frequency distribution including limits, midpoints, relative frequencies, cumulative frequencies, and boundaries.<br>• construct frequency histograms, frequency polygons, relative frequency histograms, and ogives.<br>• graph quantitative data sets using stem-and-leaf plots and dot plots. |

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| | • graph and interpret paired data sets using scatter plots and time series charts.<br>• graph qualitative data sets using pie charts and Pareto charts.<br>• find the mean, median, and mode of a population and a sample.<br>• find a weighted mean of a data set and the mean of a frequency distribution.<br>• describe the shape of a distribution as symmetric, uniform, or skewed and compare the mean and median for each.<br>• find the range of a data set.<br>• find the variance and standard deviation of a population and a sample.<br>• use the Empirical Rule and Chebychev's Theorem to interpret standard deviation.<br>• approximate the sample standard deviation for group data.<br>• find the quartiles and interquartile range of a data set.<br>• draw a box-and-whisker plot.<br>• interpret other fractiles such as percentiles.<br>• find and interpret the standard score (z-score). |

| Strategies/Modes (examples) | Materials/Resources (examples) | Assessments (examples) |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 2 (2.1 – 2.5) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |

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| **Grade:** 11-12 | **Statistics**<br><br>**Probability** |
| **Common Core Standard** | S-CP Conditional Probability and the Rules of Probability |
| **Enduring Understanding** | Probability determines the likelihood of the occurrence of an event. |
| **Essential Questions** | Assuming that the population is known, what is the probability of drawing different samples?<br>How does the dependence of two or more events affect the probability of a particular outcome?<br>What is the difference between a permutation and a combination? Why are they both necessary? |
| **Content Standard:** | **Understand independence and conditional probability and use them to interpret data**<br>S-CP-1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").<br>S-CP-2 Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.<br>S-CP-3 Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. |

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| | **Use the rules of probability to compute probabilities of compound events in a uniform probability model**<br>S-CP-6 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.<br>S-CP-7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.<br>S-CP-8 (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in terms of the model.<br>S-CP-9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems. |
| **Performance Expectations (Student outcomes)** | At the completion of this unit, students will be able to:<br>• identify the sample space of a probability experiment and identify simple events.<br>• use the Fundamental Counting Principle to find the number of ways two or more events can occur.<br>• distinguish among classical probability, empirical probability, and subjective probability.<br>• find the probability of the complement of an event and other probabilities using the Fundamental Counting Principle.<br>• find conditional probabilities.<br>• distinguish between independent and dependent events.<br>• use the Multiplication Rule to find the probability of two events occurring in sequence.<br>• determine if two events are mutually exclusive.<br>• use the Addition Rule to find the probability of two events.<br>• find the number of ways a group of objects can be arranged in order and the number of ways to choose several objects from a group without regard to order.<br>• use counting principles to find probabilities. |

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| Strategies/Modes (examples) | Materials/Resources (examples) | Assessments (examples) |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 3 (3.1 – 3.4) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |

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| **Grade:** 11-12 | **Statistics**<br><br>**Discrete Probability Distributions** |
| **Common Core Standard** | S-MD Using Probability to Make Decisions |
| **Enduring Understanding** | Discrete probability distributions allow inferences to be made when there is a finite number of possible outcomes. |
| **Essential Questions** | How can the probability distribution for a discrete random variable be illustrated?<br>What are the properties of a probability distribution for a discrete random variable? |
| **Content Standards:** | **Calculate expected values and use them to solve problems**<br>S-MD-1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.<br>S-MD-2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.<br>S-MD-3 (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*<br><br>**Use probability to evaluate outcomes of decisions**<br>S-MD-5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. |
| **Performance Expectations (Student** | At the completion of this unit, students will be able to:<br><br>• distinguish between discrete random variables and continuous random variables. |

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| **outcomes)** | • determine if a distribution is a probability distribution.<br>• construct a discrete probability distribution and its graph<br>• find the mean, variance, and standard deviation of a discrete probability distribution.<br>• find the expected value of a discrete probability distribution.<br>• determine if a probability distribution is a binomial experiment.<br>• find binomial probabilities using the binomial probability formula, table, and technology.<br>• contruct a binomial distribution and its graph.<br>• find the mean, variance, and standard deviation of a binomial probability distribution. |

| **Strategies/Modes (examples)** | **Materials/Resources (examples)** | **Assessments (examples)** |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 4 (4.1 – 4.2) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |

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| **Grade:** 11-12 | **Statistics**<br><br>**Normal Probability Distributions** |
| **Common Core Standards** | S-IC Making Inferences and Justifying Conclusions<br>S-ID Interpreting Categorical and Quantitative Data<br>S-MD Using Probability to Make Decisions |
| **Enduring Understanding** | Normal probability distributions allow inferences to be drawn when there is a continuous random variable. |
| **Essential Questions** | What is a continuous random variable?<br>How can we determine a probability distribution for a continuous random variable?<br>How can a binomial experiment be approximated using normal probability? |
| **Content Standards:** | **Understand and evaluate random processes underlying statistical experiments**<br>S-IC-1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.<br><br>**Summarize, represent, and interpret data on a single count or measurement variable**<br>S-ID-4 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. |

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| | **Summarize, represent, and interpret data on two categorical and quantitative variables**<br>S-ID-5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.<br><br>**Calculate expected values and use them to solve problems**<br>S-MD-1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.<br>S-MD-2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.<br>S-MD-3 (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*<br><br>**Use probability to evaluate outcomes of decisions**<br>S-MD-5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. |
| **Performance Expectations (Student outcomes)** | At the completion of this unit, students will be able to:<br><br>• interpret graphs of normal probability distributions.<br>• find areas under the standard normal curve.<br>• find probabilities for normally distributed variables.<br>• find a z-score given the area under the normal curve.<br>• transform a z-score to an x-value.<br>• find a specific data value of a normal distribution given the probability. |

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| | • find sampling distributions and verify their properties.<br>• interpret the Central Limit Theorem.<br>• apply the Central Limit Theorem to find the probability of a sample mean. |

| **Strategies/Modes (examples)** | **Materials/Resources (examples)** | **Assessments (examples)** |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 5 (5.1 – 5.4) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |

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| **Grade:** 11-12 | **Statistics**<br><br>**Confidence Intervals** |
| **Common Core Standard** | S-IC Making Inferences and Justifying Conclusions |
| **Enduring Understanding** | Sample statistics can be used to estimate the value of an unknown population parameter. |
| **Essential Questions** | What is the difference between a point estimate and an interval estimate?<br>What is the margin of error and how is it used in creating the confidence interval?<br>How does the sample size affect the confidence interval? |
| **Content Standards:** | **Make inferences and justify conclusions from sample surveys, experiments, and observational studies**<br>S-IC-4 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. |
| **Performance Expectations (Student outcomes)** | At the completion of this unit, students will be able to:<br><br>• find a point estimate and a margin of error.<br>• construct and interpret confidence intervals for the population mean.<br>• determine the minimum sample size required for estimating $\mu$.<br>• interpret the t-distribution and use a t-distribution table.<br>• construct confidence intervals when $n < 30$, the population is normally distributed, and $\sigma$ is unknown. |

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| Strategies/Modes (examples) | Materials/Resources (examples) | Assessments (examples) |
|---|---|---|
| • Guided practice<br>• Worksheets<br>• Homework<br>• Cooperative Group work<br>• Quizzes<br>• Tests<br>• Projects<br>• Math Labs | Elementary Statistics – Picturing the World<br>Larson and Farber 5th ed.<br><br>Chapter 6 (6.1 – 6.2) | • homework assignments<br>• quizzes<br>• tests<br>• alternative assessments |