

**MOORESTOWN TOWNSHIP PUBLIC SCHOOLS  
MOORESTOWN, NEW JERSEY**

**Moorestown High School  
Mathematics**

**AP Statistics  
*Grades 10-12***

**Date: February 2020**  
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## [Course Description and Fundamental Concepts](#)

This course follows the recommended College Board Advanced Placement course description for Statistics. The purpose of the course is to introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. The course is organized around four broad conceptual themes: exploring data: observing patterns and departures from patterns, finding ways to simplify data descriptions; planning a study: deciding what and how to measure; anticipating patterns in advance: producing models using probability and simulation; and statistical inference: confirming models. Graphing calculators are an integral part of the curriculum.

## New Jersey Student Learning Standards (NJSLs)

### **Subject/Content Standards**

*Include grade appropriate subject/content standards that will be addressed*

#### **S-ID Interpreting Categorical and Quantitative Data**

- A. Summarize, represent, and interpret data on a single count or measurement variable
  - 1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
  - 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.
  - 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
  - 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.
- B. Summarize, represent, and interpret data on two categorical and quantitative variables
  - 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.
  - 6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    - a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
    - b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
    - c. Fit a linear function for a scatter plot that suggests a linear association.
- C. Interpret linear models
  - 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
  - 8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
  - 9. Distinguish between correlation and causation.

#### **S-IC Making Inferences and Justifying Conclusions**

- A. Understand and evaluate random processes underlying statistical experiments
  - 1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
  - 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?
- B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies
  - 3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

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.
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
6. Evaluate reports based on data.

### **S-CP Conditional Probability and the Rules of Probability**

- A. Understand independence and conditional probability and use them to interpret data
  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”).
  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.
  3. Understand the conditional probability of A given B as  $P(A \text{ and } B)/P(B)$ , 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.
  4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
  5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.
- B. Use the rules of probability to compute probabilities of compound events in a uniform probability model
  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.
  7. Apply the Addition Rule,  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.
  8. (+) Apply the general Multiplication Rule in a uniform probability model,  $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$ , and interpret the answer in terms of the model.
  9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

### **S-MD Using Probability to Make Decisions**

- A. Calculate expected values and use them to solve problems
  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.
  2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

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.
  4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?
- B. Use probability to evaluate outcomes of decisions
5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
    - a. Find 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. 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.
  6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
  7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

### Mathematical Practice Standards

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

### 21st-Century Skills and Technology Integration (Standard 8)

List appropriate units below for which strands (A through F) will be addressed

<b>Standard 8.1 (K-12)</b>		<b>Educational Technology:</b> All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
<b>Unit Addressed</b>	<b>Strand Letter</b>	<b>Standard Description</b>
Units 1, 2, 3, 4	<b>Strand A</b>	<b>Technology Operations and Concepts:</b> Students demonstrate a sound understanding of technology concepts, systems, and operations.

Units 1, 2, 3, 4	<b>Strand B</b>	<b>Creativity and Innovation:</b> <i>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.</i>
Units 1, 2, 3, 4	<b>Strand C</b>	<b>Communication and Collaboration:</b> <i>Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.</i>
Units 1, 2, 3, 4	<b>Strand D</b>	<b>Digital Citizenship:</b> <i>Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.</i>
Units 1, 2, 3, 4	<b>Strand E</b>	<b>Research and Information Fluency:</b> <i>Students apply digital tools to gather, evaluate, and use information.</i>
Units 1, 2, 3, 4	<b>Strand F</b>	<b>Critical thinking, problem-solving, and decision making:</b> <i>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.</i>

**Career Ready Practices ([Standard 9](#))**

*List appropriate units below for which CRPs will be addressed*

<b>Unit Addressed</b>	<b>Standard #</b>	<b>Standard Description</b>
Units 1, 2, 3, 4	<b>CRP1</b>	<i>Act as a responsible and contributing citizen and employee.</i>
Units 1, 2, 3, 4	<b>CRP2</b>	<i>Apply appropriate academic and technical skills.</i>
	<b>CRP3</b>	<i>Attend to personal health and financial well-being.</i>
Units 1, 2, 3, 4	<b>CRP4</b>	<i>Communicate clearly and effectively and with reason.</i>
Units 1, 2, 3, 4	<b>CRP5</b>	<i>Consider the environmental, social and economic impacts of decisions.</i>
Units 1, 2, 3, 4	<b>CRP6</b>	<i>Demonstrate creativity and innovation.</i>
Units 1, 2, 3, 4	<b>CRP7</b>	<i>Employ valid and reliable research strategies.</i>
Units 1, 2, 3, 4	<b>CRP8</b>	<i>Utilize critical thinking to make sense of problems and persevere in solving them.</i>
Units 1, 2, 3, 4	<b>CRP9</b>	<i>Model integrity, ethical leadership, and effective management.</i>



	<b>CRP10</b>	<i>Plan education and career paths aligned to personal goals.</i>
Units 1, 2, 3, 4	<b>CRP11</b>	<i>Use technology to enhance productivity.</i>
Units 1, 2, 3, 4	<b>CRP12</b>	<i>Work productively in teams while using cultural global competence</i>

### Interdisciplinary Connections

List any other content standards addressed as well as appropriate units

### Visual & Performing Arts Integration ([Standard 1](#))

List appropriate units below for which standards (1.1 through 1.4) may be addressed

Unit Addressed	Standard #	Standard Description
	<b>Standard 1.1</b>	<b>The Creative Process:</b> <i>All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theatre, and/or visual art.</i>
	<b>Standard 1.2</b>	<b>History of the Arts and Culture:</b> <i>All students will understand the role, development, and influence of the arts throughout history and across cultures.</i>
	<b>Standard 1.3</b>	<b>Performing/Presenting/Producing:</b> <i>All students will synthesize those skills, media, methods, and technologies appropriate to creating, performing, and/or presenting works of art in dance, music, theatre, and/or visual art.</i>
	<b>Standard 1.4</b>	<b>Aesthetic Responses &amp; Critique Methodologies:</b> <i>All students will demonstrate and apply an understanding of arts philosophies, judgment, and analysis to works of art in dance, music, theatre, and/or visual art.</i>

### Other Interdisciplinary Content Standards

List appropriate units below for any other content/standards that may be addressed

Unit Addressed	Content / Standard #	Standard Description
Unit 1, 2, 3	9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education
Unit 1	6.3.12.A.2	Compare current case studies involving child labor in the United States with those of other nations, and evaluate the extent to which such problems are universal.

Unit 2	6.2.12.D.6.a	Assess the role of increased personal and business electronic communications in creating a “global” culture, and evaluate the impact on traditional cultures and values.
Unit 3	HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
Unit 4	6.2.12.C.6.d	Determine how the availability of scientific, technological, and medical advances impacts the quality of life in different countries.
Unit 4	6.2.12.B.6.a	Determine the global impact of increased population growth, migration, and changes in urban-rural populations on natural resources and land use.

**Pacing Guide** (All Dates are approximate based on the school calendar)

<b>Unit/ Topic</b>	<b>Month</b> (w/Approx number of Teaching Days)
<b>UNIT 1: Understanding Data</b> Stats Start Here Data Displaying and Describing Categorical Data Displaying and Summarizing Quantitative Data Understanding and Comparing Distributions The Standard Deviation as a Ruler and Normal Model	<b>September</b> (~19 days)
<b>UNIT 1: Understanding Data</b> Scatter plots, Associations and Correlation Linear Regression Regression Wisdom Re-expressing Data	<b>October</b> (~19 days)
<b>UNIT 2: Gathering Data</b> Understanding Randomness Sample Surveys Experiments and Observational Studies	<b>November</b> (~16 days)
<b>UNIT 3: Randomness and Probability</b> From Randomness to Probability Probability Rules Random Variables	<b>December</b> (~15 days)
<b>UNIT 3: Randomness and Probability</b> Random Variables Probability Models	<b>January</b> (~18 days)
<b>UNIT 4: From the Data at Hand to Learning about the World</b> Sampling Distribution Models Confidence Intervals for Proportions Testing Hypotheses About Proportions	<b>February</b> (~18 days)
<b>UNIT 4: From the Data at Hand to Learning about the World</b> Testing Hypotheses About Proportions Tests and Intervals Comparing Two Proportions	<b>March</b> (~15-20 days)
<b>UNIT 4: From the Data at Hand to Learning about the World</b> Sampling Distribution Models Confidence Intervals for Proportions Testing Hypotheses About Proportions	<b>April</b> (~15-20 days)
<b>UNIT 4: From the Data at Hand to Learning about the World</b> Tests and Intervals Comparing Two Proportions  <b>AP Exam</b>	<b>May</b> (~18 days)
<b>UNIT 5: Gathering Data - Student projects and exploration</b>	<b>June</b> (~15 days)

## [Units](#)

Contact the Content Supervisor for unit details.