

Haddon Township High School
Course Overview

Subject Area: Math
Course Name: AP Statistics

Summary: 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, as well as the concepts of probability.

Unit Title	Student Learning Target	Standards	Resources	Assessment
Unit 1 Exploring Data	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Calculate a distributions numerical summary • Display a distribution with a graph • Describe a distribution using the center and spread • 	<p><input type="checkbox"/> S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).</p> <p><input type="checkbox"/> 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.</p> <p><input type="checkbox"/> 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).</p> <p>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</p>	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>Tests Quizzes AP Questions</p>

		possible associations and trends in the data.		
Unit 2 Modeling Distributions of Data	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Be able to calculate a z-score • Be able to write the mean and standard deviation of a density curve • Recognize a standard normal distribution, and its normal density curve • Be able to use the empirical rule to describe the percent of observation 1-2-3 standard deviations from the mean • 	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.	Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman Graphing Calculator Website: AP Central	Tests Quizzes AP Questions
Unit 3 Describing Relationships	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Display relationships on a scatterplot • Interpret scatterplots • Measure linear association, correlation • Interpret a regression line • Calculate the equation of the least squares regression line • Determine how well the line fits the data using residual plots and r-squared 	Summarize, represent, and interpret data on two categorical and quantitative variables <ul style="list-style-type: none"> • S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. <ul style="list-style-type: none"> ○ a. Fit a function to the data; use 	Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman Graphing Calculator Website: AP Central	Tests Quizzes AP Questions

		<p>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, quadratic, and exponential models.</p> <ul style="list-style-type: none">○ b. Informally assess the fit of a function by plotting and analyzing residuals.○ c. Fit a linear function for a scatter plot that suggests a linear association. <p>Interpret linear models</p> <ul style="list-style-type: none">• S-ID.7. Interpret		
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		<p>the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p> <ul style="list-style-type: none"> • S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. • S-ID.9. Distinguish between correlation and causation. 		
<p>Unit 4</p> <p>Designing Studies</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Be able to discern between the various sampling methods • Choose a simple random sample by labeling and using random digits • Recognize bias in certain sampling methods • Be able to differentiate between an observational study versus an experiment • Recognize the three principles of experimental design <p>Design an experiment</p>	<p>Make inferences and justify conclusions from sample surveys, experiments, and observational studies</p> <ul style="list-style-type: none"> • S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. • 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 	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>Tests Quizzes AP Questions</p>

		<p>sampling.</p> <ul style="list-style-type: none"> • S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. • S-IC.6. Evaluate reports based on data. 		
<p>Unit 5</p> <p>Probability</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Be able to interpret probability as a long-run relative frequency • Be able to use simulation to model chance behavior • Describe a probability model for a chance process • Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events. • Use a Venn diagram to model a chance process involving two events • Use the General Addition rule to calculate $P(A \cup B)$ • When appropriate use a tree diagram to describe 	<ul style="list-style-type: none"> • 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"). • 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 	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>Tests Quizzes AP Questions</p>

	<p>chance behavior.</p> <ul style="list-style-type: none">• Use the general multiplication rule to solve probability questions.• Compute conditional probabilities.• Determine whether two events are independent.• Find the probability that an event occurs using a two-way table.• When appropriate, use the multiplication rule for independent events to compute probabilities.	<p>use this characterization to determine if they are independent.</p> <ul style="list-style-type: none">• S-CP.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.• S-CP.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..• S-CP.5. Recognize and explain the concepts of		
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		<p>conditional probability and independence in everyday language and everyday situations.</p> <ul style="list-style-type: none">• 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.• S-CP.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.• S-CP.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.• S-CP.9. (+) Use combinations to compute probabilities of compound events and solve		
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		problems.		
Unit 6 Random Variables	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Use a probability distribution to answer questions about possible values of a random variable. • Calculate the mean and standard deviation of a discrete random variable. • Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant. • Find the mean and standard deviation of the sum or difference of independent random variables. • Interpret the mean and standard deviation of a random variable. • Find the mean and standard deviation of the sum or difference of independent random variables. • Determine whether 2 random variables are independent. • Find probabilities involving the sum or difference of independent Normal random variables. 	<ul style="list-style-type: none"> • 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. • S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. • 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. • S-MD.4. (+) Develop a probability 	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>Tests Quizzes AP Questions</p>

	<ul style="list-style-type: none"> • Determine whether the conditions for a binomial random variable are met • Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context. • Compute and interpret probabilities involving binomial distributions. • Find probabilities involving geometric random variables. • Determine if the conditions for the Normal approximation to a binomial distribution are met. • When appropriate, use the Normal approximation to estimate probabilities in a binomial setting. 	<p>distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.</p>		
<p>Unit 7 Sampling Distribution</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Distinguish between a parameter and a statistic • Understand the definition of a sampling distribution • Distinguish between population distribution, sampling distribution, and the distribution of sample data. • Determine whether a statistic is an unbiased estimator of a population 	<ul style="list-style-type: none"> • S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. <p>S-IC.2. Decide if a specified model is consistent with results from a given data-</p>	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>Tests Quizzes AP Questions</p>

	<p>parameter.</p> <ul style="list-style-type: none">• Understand the relationship between sample size and the variability of an estimator• Find the mean and standard deviation of the sampling distribution of a sample proportion \hat{p} for an SRS of size n from a population having proportion p of successes• Check whether the 10% and Normal conditions are met in a given setting• Use Normal approximation to calculate probabilities involving \hat{p}• Use the sampling distribution of \hat{p} to evaluate a claim about a population proportion.• Find the mean and standard deviation of the sampling distribution of a sample mean \bar{x} from an SRS of size n.• Calculate probabilities involving a sample mean \bar{x} when the population distribution is Normal• Explain how the shape of the sampling distribution of \bar{x} is related to the shape of the population	generating process		
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	<p>distribution.</p> <ul style="list-style-type: none"> • Use the Central Limit theorem to help find probabilities involving a sample mean \bar{x}. 			
<p>Unit 8</p> <p>Estimating with Confidence</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Understand why each of the three inference conditions-Random, Normal and Independent- is important. • Determine the critical values for calculating a confidence interval using a table or your calculator. • Interpret a confidence interval • Interpret a confidence interval in context • Determine sample statistics from a confidence interval • Carry out the steps in constructing a confidence interval for a population proportion: define the parameter, check conditions, perform calculations, interpret results in context. • Carry out the steps in constructing a confidence interval for a population mean: define the parameter, check conditions, perform 	<ul style="list-style-type: none"> <input type="checkbox"/> S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. <input type="checkbox"/> S-IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. 	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p> <p>Graphing Calculator</p> <p>Website: AP Central</p>	<p>Tests</p> <p>Quizzes</p> <p>AP Questions</p>

	<p>calculations, interpret results in context.</p> <ul style="list-style-type: none"> • Determine the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error. • Construct and interpret a confidence interval for a population proportion. • Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval. • Construct and interpret a confidence interval for a population mean. • Understand that a confidence interval gives a range of plausible values for the parameter. • Determine the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error. • Understand how the margin of error of a confidence interval changes with the sample size and the level of confidence C. 			
Unit 9	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • State correct hypotheses 	<input type="checkbox"/> S-IC.1. Understand statistics as a process for	Textbook: Starnes, Yates & Moore, The Practice of	Tests Quizzes

Testing a Claim	<p>for a significance test about a population proportion or mean</p> <ul style="list-style-type: none"> • Check conditions for carrying out a test about a population proportion or mean. • Interpret P-values in context • Interpret a Type I and Type II error in context, and give the consequences of each. • Understand the relationship between the significance level of a test, $P(\text{Type II error})$, and power. • If conditions are met, conduct a significance test about a population proportion. • If conditions are met, conduct a one-sample t-test about a population mean μ. • Use a confidence interval to draw a conclusion for a two sided test about a population mean. • Recognize paired data and use one-sample t procedures to perform significance tests for such data. 	<p>making inferences about population parameters based on a random sample from that population.</p> <p><input type="checkbox"/> S-IC.2. Decide if a specified model is consistent with results from a given data-generating process</p>	<p>Statistics 2010, Freeman</p> <p>Graphing Calculator Website: AP Central</p>	<p>AP Questions</p>
<p>Unit 10</p> <p>Comparing two populations</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Determine the proper inference procedure to 	<p><input type="checkbox"/> S-IC.1. Understand statistics as a process for making inferences about</p>	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p>	<p>Tests Quizzes AP Questions</p>

<p>or groups</p>	<p>use in a given setting</p> <ul style="list-style-type: none"> • Construct and interpret a confidence interval to compare two proportions • Check conditions for using two-sample t procedures in a randomized experiment • Interpret the results of inference procedures in a randomized experiment • Use a two-sample t procedures to compare two means based on summary statistics • Perform a significance test to compare two proportions • Determine whether the conditions for performing inference are met. • Use two-sample t procedures to compare two means from raw data. • Use confidence intervals to correctly estimate an unknown proportion. • Use an appropriate inference procedure to compare tow proportions • Interpret standard computer output for two-sample t procedures 	<p>population parameters based on a random sample from that population.</p> <p><input type="checkbox"/> S-IC.2. Decide if a specified model is consistent with results from a given data-generating process</p>	<p>Graphing Calculator Website: AP Central</p>	
<p>Unit 11 Inference for Distribution</p>	<p><i>Students will ...</i></p> <ul style="list-style-type: none"> • Use a chi-square 	<p><input type="checkbox"/> S-IC.1. Understand statistics as a process for making inferences about</p>	<p>Textbook: Starnes, Yates & Moore, The Practice of Statistics 2010, Freeman</p>	<p>Tests Quizzes AP Questions</p>

of Categorical Data	<p>goodness-of-fit test to determine whether data are consistent with a specified distribution of a categorical variable.</p> <ul style="list-style-type: none"> • Check the Random, Large Sample Size and Independent conditions before performing a chi-square test. • Use a chi-square test for homogeneity to determine whether the distribution of a categorical variable differs for several populations or treatments. • Distinguish between the three types of chi-square tests • Interpret computer output for a chi-square test based on a two-way table. • Know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic. • Use a chi-square test for association/independence to determine whether there is convincing evidence of an association between two categorical variables. • Examine individual components of the chi- 	<p>population parameters based on a random sample from that population.</p> <p><input type="checkbox"/> S-IC.2. Decide if a specified model is consistent with results from a given data-generating process</p>	<p>Graphing Calculator Website: AP Central</p>	
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	<p>square statistic as part of a follow-up analysis</p> <p>Show that the two-sample z test for comparing two proportions and the chi-square test for a 2-by-2 two-way table give equivalent results.</p>			
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