Madison Public Schools

AP Statistics

Grades 11 and 12

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Course Overview

Description

AP Statistics is a full year advanced placement course offered to mathematically able students who have completed a second year of algebra. The purpose of the course is to introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Students are exposed to four broad conceptual themes: exploratory data analysis, planning a study, anticipating patterns in advance, and statistical inference. For exploratory analysis of data, students will make use of graphical and numerical techniques to study patterns and departures from patterns. For the conceptual theme of planning a study, data must be collected according to a well-developed plan if valid information on a conjecture is to be obtained. Probability will be used in this course as a tool for anticipating what the distribution of data should look like under a given model. Lastly, statistical inference will guide the selection of appropriate models. Throughout the study of these conceptual themes, students will make regular use of appropriate technological tools.

Goals

As outlined by the College Board, this course also aims to:

- describe patterns and departures from patterns
- plan and conduct a study
- explore random phenomena using probability and simulation
- estimate population parameters and test hypotheses

In addition to the goals outlined by the College Board, this course also aims to:

- enable students to make sense of various types of problems and the reasonableness of their answers
- build student confidence with the various approaches to solving a problem and persevere in solving them
- encourage students to become abstract thinkers who make sense of quantities and their relationships in problem situations
- develop students' ability to cooperatively discuss, make conjectures and critique ideas of one another
- use, apply, and model mathematics to solve problems arising in everyday life, society, and the workplace
- consider the variety of available tools when solving a mathematical problem
- communicate mathematical ideas precisely and effectively to others
- determine a pattern or analyze structure within mathematical content to apply to related ideas
- use repeated reasoning to follow a multi-step process through to completion

Materials

Core: The Practice of Statistics 4th ed.
Supplemental: Khan Academy, Various websites related to AP Stastics

Resources

Suggested activities and resources page

Benchmark Assessments
Common Benchmark Assessment are given for each unit with common types of questions across the levels including problems that focus on the main ideas and anchor standards of the course.
Modifications and Adaptations for Special Needs Learners (Gifted and Talented Students, English Language Learners, Special Education Students, At-Risk Students)

Scope and Sequence
(Pacing Guide)

Unit Number	Topic of Study	Duration (Lessons Taught)
1	Exploring Data	4 lessons
2	Modeling Distribution of Data	6 lessons
3	Describing Relationships	8 lessons
4	Designing Studies	8 lessons
5	Probability	10 lessons
6	Random Variables	9 lessons
7	Sampling Distribution	10 lessons
8	Confidence Intervals	10 lessons
9	Significance Testing	8 lessons
10	Comparing Two Populations	9 lessons
11	Chi-Squared and Inference for Linear Regression	4 lessons
12	AP Statistics Exam Review	10 lessons
13	Projects and Activities to extend learning after the AP Statistics Exam	15 lessons

Unit 1 Overview
Unit Title: Exploring Data
Unit Summary: This unit introduces the idea of distribution and the distinction between quantitative and categorical variables. This will be more than simply a collection of data but an

exploration of the various ways to see and use that data. The focus will be on the true understanding of the concepts and not just the mechanics.
Suggested Pacing: Summer Assignment plus 4 Lessons
Learning Targets
Unit Essential Questions: ● How does the type of data influence the choice of graph? ● What kinds of questions can be answered using different data displays? ● What data display is appropriate for a given set of data? ● How do you interpret the data you have collected?
Unit Enduring Understandings: ● Data distributions can be displayed graphically to visualize shape, center, spread and potential outliers. ● Data distributions can be analyzed numerically for center, spread, and potential outliers.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc…
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, data, the display of data, the interpretation of data, and data distributions. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Identify the individuals and variables in a set of data. Classify variables as categorical or quantitative. Identify units of measurement for quantitative variables. Make a bar graph of the distribution of a categorical variable. Recognize when a pie chart can and cannot be used. Identify deceptive graphs.. From a two-way table of counts, answer questions involving marginal and conditional distributions. Describe the relationship between two categorical variables. Construct bar graphs to display the relationship between two categorical variables. Make a dot plot, boxplot or stemplot to display small sets of data. Describe the overall pattern (CUSS: center, unusual observations, shape, spread) of distribution. Make a histogram with the graphing calculator. Identify the shape of a distribution from a dotplot, stemplot, or histogram as roughly symmetric or skewed. Identify the number of modes. Interpret histograms. Calculate and interpret measures of centers and spreads Identify possible and calculate actual outliers Use and find standard deviation	Content: dotplots stemplots histograms boxplot shape center spread outliers standard deviation Skills: Using histograms Comparing distributions Comparing measures of center in different distributions Measuring spread Finding standard deviation	Summer Assignment Resources from *The Practice of Statistics* textbook "Matching plots to variables" (Page 14 AB) AP Free Response Questions: 2000 Questions 3 2001 Question 1 2002B Question 5 2004 Question 1 2005B Question 1 2006 Question 1 2007B Question 1 2010B Question 1 Group Activity - Students can use their flash cards from the summer assignment to quiz each other before the vocabulary test. Gallery Walk - Teacher can pick select problems from summer packet and students can write the solutions on posters and the students can check each other.	s-ID.1 Represent data with plots on the real number line (dot plots, histograms, and boxplots). 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. 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). CRP 11 Use technology to enhance productivity CRP 2 Apply appropriate academic and technical skills MP3 Construct viable arguments and critique the reasoning of others 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	4 Lessons

Unit 2 Overview
Unit Title: Modeling Distribution of Data
Unit Summary: In this unit, students will look at two different ways to measure an individual's location in a distribution: percentiles and z-scores. This will lead to a discussion of how various transformations affect the characteristics of a distribution. When a distribution had a clear overall pattern, that pattern can be modeled with a smooth curve, called a density curve, which will be explored. The unit will explore the most commonly used density curve (the Normal curve), a symmetric bell-shaped curve that is a good model for the distribution of many different quantitative variables. Students will learn to use the Normal curve to identify percentiles.
Suggested Pacing: 6 Lessons
Learning Targets
Unit Essential Questions: ● How are measures of center and spread affected by extreme observations? ● How can we tell if a distribution is Normal? ● What happens to measures of center and spread when data is transformed by linear combinations?
Unit Enduring Understandings: ● The mean and median of a symmetric density curve are the same; a skewed distribution will pull the mean towards the tail.The location of a dataset refers to its center. ● A combination of context, graphs and calculations can be used to decide if a distribution is approximately Normal. ● Center and Spread will be affected in a pattern when transformed by linear combinations.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc…
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, mean, median, range, shape, spread, normal distribution, linear transformations, and area of curve. The assessment will also contain multiple AP open-ended like questions that assess the same material.
Alternative Assessment: Students will create a multimedia presentation proving the normality of a set of data they are provided.

Objectives (Students will be able to…)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Use percentiles to locate individual values within distributions of data.	Content: Cumulative relative frequency	Normal Density Curve Applet	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.	1 Lesson

Interpret a cumulative relative frequency graph (Ogive). Find the standardized value (z score) of an observation. Interpret z-scores in context. Describe the effects of adding, subtracting, multiplying or dividing by a constant on the shape, center and spread of a distribution of data. Approximately locate the median and mean on a density curve.	Ogive Mean and Median Z-scores and Percentiles Density curves Skills: Measure percentile Calculate z-score Interpret z-scores and percentiles Transform data Describe density curves	http://bcs.whfreeman.com/tps4e/#628644__925299 AP Free Response 1997 Question 1 2006B Question 1 2008 Question 1 2009B Question 1 Exploration Activity- Have students take a set of data and perform the operations to them and see how that affects the shape, center, and spread of the distribution graph.	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. CPR 8 Utilize critical thinking to make sense of problems and persevere in solving them. MP.1 Make sense of problems and persevere in solving them MP.4 Model with mathematics MP.5 Use appropriate tools strategically	
Use 68-95-99.7 rule to estimate the percent of observations from a Normal distribution that fall in an interval involving points one, two, or three standard deviations on either side of the mean. Use the standard Normal distribution to calculate the proportion of values in a specified interval. Use the standard Normal distribution to determine a z-score from a percentile.	Content: 68-95-99.7 Rule Normal distribution curve Standard Normal distribution Standard Deviations Proportions Skills: Calculate percents in a certain interval Calculate z-scores from given information	Computer Activity -view Through the Eyes of a Statistician; Have students search for real world examples that have the 68-95-99.7 Rule.	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. MP.5 Use appropriate tools strategically MP.6 Attend to precision 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.	1 Lesson
Use the z-score table to find the percentile of a value from any Normal distribution and the value that corresponds to a given percentile. Use the z-score table to find the percent of observations that fall above a value or between two values.	Content: z-score table Skills: Use the z-score table to find percents from a value Use the z-score table to find the value given a percent	Quiz Question - How would you interpret a z-score that does not show up on the table?	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. MP.6 Attend to precision	1 Lesson
Make an appropriate graph to determine if a distribution is approximately Normal. Use the 68-95-99.7 rule to assess Normality of a data set. Interpret a Normal probability plot.	Content: Normality Normal Probability plot Skills: 68-95-99.7 application for Normality Graphing appropriately	Discussion Question - Why does the 68-95-99.7 Rule give us a reason as to why data can be considered Normal?	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. 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	1 Lesson followed by 2 lessons of review and assessment

Unit 3 Overview
Unit Title: Describing Relationships
Unit Summary: In this unit, students will look at relationships between two quantitative variables. They will use scatterplots to display the relationships between two variables, correlation to measure the strength and direction of a linear association and a least-squares regression line to model a relationship. They will use logarithmic transformations to achieve linearity and use those transformations to model nonlinear relationships.
Suggested Pacing: 8 Lessons
Learning Targets
Unit Essential Questions: ● How can the appropriateness of a linear regression model be determined? ● How do you determine which of several transformations does a better job of producing a linear relationship?
Unit Enduring Understandings: ● Residuals from regression analysis can be used to analyze the appropriateness of the fit for both linear and nonlinear associations.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, what influences data, strengths of relationships, association, causation, and regression. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Describe why it is important to investigate relationships between variables. Identify explanatory and response variables in situations where one variable helps to explain or influence the other. Make a scatterplot to display the relationship between two quantitative variables.	Content: Explanatory and response variables Correlation Skills: Display relationships in scatterplots Interpret scatterplots Measure linear correlation	Resources from The Practice of Statistics textbook plus “Matching Descriptions to Scatterplots” (Page 39 AB), Leonardo’s Model Bodies (Page 48 AB) AP Free Response 2000 Question 1 2002B Question 1	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. MP.3 Construct viable arguments and critique the reasoning of others	1 Lessons

Describe the direction, form, and strength of the overall pattern of a scatterplot. Recognize outliers in a scatterplot. Know the basic properties of correlation. Calculate and interpret correlation in context. Explain how the correlation r is influenced by extreme observations.				
Interpret the slope and y- intercept of a least-squares regression line in context. Use the least-squares regression line to predict y for a given x. Explain the dangers of extrapolation. Calculate and interpret residuals in context. Explain the concept of least squares. Use technology to find a least-squares regression line. Find the slope and intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.	Content: Predictions Residuals Least-squares regression line Extrapolation/interpolation Skills: Interpret a regression line Calculating least-squares regression line Find a least-squares regression line using the graphing calculator	AP Free Response 1999 Question 1 2007B Question 4 Partner Activity - Use the Correlation and Regression applet to place the LSRL on a scatterplot to see why we need to have a way to calculate the same line.	S-ID.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; 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, quadratic, and exponential models. 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. S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID.9 Distinguish between correlation and causation. CRP.11 Use technology to enhance productivity. MP.7 Look for and make use of structure MP.8 Look for and express regularity in repeated reasoning NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.	1 Lesson

Construct and interpret residual plots to assess if a linear model is appropriate. Use the standard deviation of the residuals to assess how well the line fits the data. Use r^2 to assess how well the line fits the data. Interpret the standard deviation of the residuals and r^2 in context. Identify the equation of a least-squares regression line from computer output. Explain why association doesn't imply causation. Recognize how the slope, y-intercept, standard deviation of the residuals, and r^2 are influenced by extreme observations.	Content: Residual Plots Role of r^2 in regression Correlation and Regression wisdom Skills: Interpret computer regression output	Resources from The Practice of Statistics textbook plus "Models, Models, Models" (Page 58 AB) AP Free Response 2003B Question 1 2005 Question 3 Calculator Activity - Compare residual plots for different models to choose the best model.	S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. d. Fit a function to the data; 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, quadratic, and exponential models. e. Informally assess the fit of a function by plotting and analyzing residuals. f. Fit a linear function for a scatter plot that suggests a linear association. S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID.9 Distinguish between correlation and causation. MP.2 Reason abstractly and quantitatively MP.3 Construct viable arguments and critique the reasoning of others	2 Lessons
Use transformations involving powers and roots to achieve linearity for a relationship between two variables. Make predictions from a least-squares regression line involving transformed data. Use transformations involving logarithms to achieve linearity for a relationship between two variables. Determine which of several transformations does a better job of producing a linear relationship.	Content: Transforming Power Model Logarithm Model Skills: Transforming with powers and roots Transforming with logarithms	Resources from The Practice of Statistics textbook AP Free Response 1997 Question 6 2007B Question 6 Solo Activity - Students will complete "The Helicopter Experiment" from the teacher resource binder. Have students write a journal entry after about what they learned and at least two other example of when the same methods could be applied.	Does not align to any CCSS MP.2 Reason abstractly and quantitatively MP.3 Construct viable arguments and critique the reasoning of others 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	2 Lessons followed by 2 lessons of review and assessment

Unit 4 Overview
Unit Title: Designing Studies
Unit Summary: This unit will cover how to design studies. To design a well thought out and statistically accurate study requires more than just a great question. Sampling method, inference, bias, lurking variables, and blocking are some of the areas that will be explored in this unit.
Suggested Pacing: 8 Lessons

Learning Targets
Unit Essential Questions: ● How can the appropriate sampling method be chosen? ● What are the key elements of a well designed experiment?
Unit Enduring Understandings: ● Samples are chosen to best represent the population of interest. ● Well-designed experiments should include randomization, replication and comparison.

Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, collecting data, organizing data, displaying data, interpreting data, randomization, designing experiments and placebo effect. The assessment will also contain multiple AP open-ended like questions that assess the same material.
Alternative assessments: Students will create survey questions and collect data then they will review their peers questions and data to determine bias and data manipulation.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Identify the population and sample in a sample survey. Identify voluntary response samples and convenience samples. Explain how these bad sampling methods can lead to bias. Describe how to use Random Digits to select a simple random sample (SRS). Distinguish a simple random sample from a stratified random sample or cluster sample. Give advantages and disadvantages of each sampling method. Explain how undercoverage, nonresponse, and question wording can lead to bias in a sample survey.	Content: Sample Survey Sampling methods Inference for sampling Skills: Identify good sampling Deciding which sampling method is best. Generate random digits. Be able to identify voluntary responses.	Resources from The Practice of Statistics textbook plus “The Rating Game” (Page 89 AB) AP Free Response 2003 Question 4 2004B Question 2 2005 Question 1 2006 Question 5 2006B Question 5 2009 Question 3 2010 Question 1 2010B Question 2 Quiz Question - What are the positives and negatives to the various types of sampling methods?	S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. CRP.1 Apply appropriate academic and technical skills SL.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others’ ideas and expressing their own clearly and persuasively. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are	2 Lessons

			appropriate to task, purpose, and audience.	
Distinguish between an observational study and an experiment. Explain how a lurking variable in an observational study can lead to confounding. Identify the experimental units or subjects, explanatory variables (factors), treatments, and response variables in an experiment. Describe a completely randomized design for an experiment. Explain why random assignment is an important experimental design principle. Distinguish between a completely randomized design and a randomized block design. Know when a matched pairs experimental design is appropriate and how to implement such a design.	Content: Observational Study Experimental Study Three Principles of Experimental Design Blocking Matched Pairs Design Skills: How to do an experiment well Inference for Experiments How to use blocking	Resources from The Practice of Statistics textbook plus "Jumping Frogs" (Page 104 AB) AP Free Response 1997 Question 2 1999 Question 3 2000 Question 5 2001 Question 4 2002B Question 3 2004 Question 2 2007 Question 2 2007B Question 3 Bias Project - Create two survey questions, one that is biased and one that isn't. Give the survey using appropriate methods, observe the results, and explain how bias affected the results.	S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. CRP4. Communicate clearly and effectively and with reason. MP.1 Make sense of problems and persevere in solving them MP.4 Model with mathematics RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.	3 Lessons
Determine the scope of inference for a statistical study. Evaluate whether a statistical study has been carried out in an ethical manner.	Content: Scope of Inference The challenges of establishing causation Data Ethics	Partner Activity - Look online for very recent surveys and determine if they were completed properly. If they were, how could they be changed to not be completed properly. If they were what could be manipulated to complete them properly.	S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. MP.1 Make sense of problems and persevere in solving them MP.4 Model with mathematics 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	1 Lessons followed by 2 lessons of review and assessment

Unit 5 Overview
Unit Title: Probability
Unit Summary: This unit explores the basics of probability, including permutations, combinations, compound events, independent events, and conditional probability.
Suggested Pacing: 10 Lessons
Learning Targets
Unit Essential Questions: • How is the probability of an event determined and described? • What are the steps of a well-designed simulation?
Unit Enduring Understandings: • The rules of probability are not always intuitive to human understanding. • Probability is an empirical phenomenon. • Simulation can be used to approximate a probability distribution.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, probability, independent events, dependent events, conditional probability, and simulation . The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	Essential Content/Skills	Suggested Assessments	Standards (NJSLS)	Pacing
Interpret probability as a long-run relative frequency in context. Use simulation to model chance behavior.	Content: Probability Myths about randomness Simulation	AP Free Response 2001 Question 3 Solo Activity - Write down a “random” list of 50 heads and tails. Now run a simulation using the graphing calculator. Which list has longer “runs” of the same outcome? Student’s list is really not as random as you think. Make a journal entry giving reasons why your numbers might not be really random.	NO CCSS MP.7 Look for and make use of structure	3 Lessons
Describe a probability model for a chance process.	Content: Probability models Rules of probability	Resources from The Practice of Statistics textbook plus “What’s the Chance” (Page 143 AB)	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.	2 Lessons

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 ∪ B)	Two-way tables and probability Venn diagrams Skills: Using the Addition Rule Making a Venn diagram using probabilities	AP Free Response 1997 Question 3 Group Activity - Split students into two groups. One group will learn the Addition Rule and the other group will learn the Multiplication Rule. Students will then share out to a partner what they learned and help that other student learn the material.	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. S-CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems. MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively	
When appropriate, use a tree diagram to describe chance behavior. Use the general multiplication rule to solve probability questions. 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. Compute conditional probabilities.	Content: Conditional Probability Independence Multiplication Rule Skills: Making a rree diagram using probabilities Calculate conditional probabilities	AP Free Response 2003B Question 2 2009B Question 2 See group activity above	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.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. CRP4. Communicate clearly and effectively and with reason. MP.1 Make sense of problems and persevere in solving them MP.4 Model with mathematics 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	3 Lessons followed by 2 lessons of review and assessment

Unit 6 Overview

Unit Title: Random Variables

Unit Summary: This unit explores the principle concepts of random variable assignment and special types of distributions.

Suggested Pacing: 9 Lessons

Learning Targets

Unit Essential Questions:
- What is a random variable?
- What happens to measures of center and spread when you combine random variables?
- How can you tell if a random variable has a binomial distribution?

Unit Enduring Understandings: ● Random variables must take numerical values. ● Distributions of random variables behave predictably when transformed via linear combinations. ● The binomial setting can be used to determine if a binomial distribution is appropriate for a discrete random variable.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to,random variables, randomness, binomial distribution, and transformations. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Use a probability distribution to answer questions about possible values of a random variable. Calculate the mean of a discrete random variable. Interpret the mean of a random variable in context. Calculate the standard deviation of a discrete random variable. Interpret the standard deviation of a random variable in context.	Content: Discrete random variables Expected value (mean) of discrete random variable Standard deviation and variance of discrete random variable Continuous random variable	AP Free Response 1999 Question 4 1999 Question 5 2001 Question 2 2005 Question 2 2005B Question 2 2008 Question 3 2010 Question 4 Exploration Activity - Have students complete the “Bottled Water versus Tap Water” activity on Page 340. Journal Entry - “Explain why an expected value does not have to equal a possible value.”	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 distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. MP.2 Reason abstractly and quantitatively MP.6 Attend to precision SL.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others’ ideas and expressing their own clearly and persuasively. NJSLSA.W4. Produce clear and coherent writing in which the development,	2 Lessons

			organization, and style are appropriate to task, purpose, and audience.	
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. Determine whether two random variables are independent. Find probabilities involving the sum or difference of independent Normal random variables.	Content: Linear transformations Combining random variables Combining normal random variables Skills: Finding mean and standard deviation Finding probabilities involving sum or difference of independent normal random variables	AP Free Response 1998 Question 6 2002 Question3 2002B Question 2 2003 Question 3 2004 Question 3 2008B Question 5 Computer Activity - Give students a set of random variables and have them perform transformations on them using a spreadsheet. Have students take notes on what happens, then share on a google doc. Use Wolfram-Alpha site to calculate changes in distributions.	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 distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. CRP11. Use technology to enhance productivity MP.5 Use appropriate tools strategically	2 Lessons
Determine whether the conditions for a binomial random variable are met. Compute and interpret probabilities involving binomial distributions. Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context. Find probabilities involving geometric random variables	Content: Binomial settings Binomial random variables Binomial probabilities Mean and standard deviation of binomial distribution Binomial distribution in statistical sampling Geometric random variables Skills: Compute probabilities involving binomial distributions Calculate mean and standard deviation Find probabilities involving geometric random variables	Resources from The Practice of Statistics textbook plus “”Waiting for Sammy Sosa” (Page 136 AB) and “The Lazy Student” (Page 140 AB) AP Free Response 1999 Question 4 2006B Question 3 2010 Question 4 2010B Question 3 Quiz Question - “Derive the formula for geometric probability from the complement rule and multiplication rule.”	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 distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. CRP4. Communicate clearly and effectively and with reason. MP.7 Look for and make use of structure 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	3 Lessons followed by 2 lessons of review and assessment

Unit 7 Overview
Unit Title: Sampling Distribution
Unit Summary: This unit explores the principle concepts of center, shape, and spread of qualitative and quantitative sampling distributions. These characteristics make up the foundation for inferential statistics.
Suggested Pacing: 10 Lessons
Learning Targets
Unit Essential Questions: ● How do sampling distributions relate to population distributions? ● What is the difference between bias and variability of a sampling distribution? ● How does the Central Limit Theorem help us to know the shape and variability of a sampling distribution?
Unit Enduring Understandings: ● Sampling distributions can be known when population distributions are unknown. ● The most useful sampling distributions have low bias and low variability. ● The Normal distribution and the Central Limit Theorem are essential to analyzing samples of data.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc…
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, sampling distributions, population distributions, central limit theorem, and law of large numbers. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to…)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
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	Content: Parameters and statistics Sampling variability Skills: Describing sampling distributions Determining unbiased sampling distributions	Resources from The Practice of Statistics textbook plus AP Free Response 2008B Question 2 Group activity: Using goldfish and pretzel fish, students will use the capture and recapture method to estimate number of goldfish in the population.	S-MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. S-MD.7 Analyze decisions and strategies using probability concepts. S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. MP.4 Model with mathematics MP.5 Use appropriate tools strategically	2 Lessons

estimator of a population parameter. Understand the relationship between sample size and the variability of an estimator.		Quiz Question - Will taking a larger sample eliminate bias?		
Find the mean and standard deviation of the sampling distribution of a sample proportion pˆ 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.	Content: Sampling distribution of $\hat{p}$ Skills: Using Normal approximation for $\hat{p}$	Resources from The Practice of Statistics textbook plus "Spinning Pennies" (page 147 AB) and "How Accurate Are The Polls?" (Page 157 AB) AP Free Response 1998 Question 1 2004B Question 3 2006 Question 3 2009 Question 2 2010 Question 2	S-MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. S-MD.7 Analyze decisions and strategies using probability concepts. S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. CRP4. Communicate clearly and effectively and with reason. MP.7 Look for and make use of structure	3 Lessons
Find the mean and standard deviation of the sampling distribution of a sample mean x from an SRS of size n. Calculate probabilities involving a sample mean x when the population distribution is Normal. Explain how the shape of the sampling distribution of x is related to the shape of the population distribution. Use the central limit theorem to help find probabilities involving a sample mean x .	Content: Sampling distribution of sample mean x Sampling for a Normal population Central limit theorem	AP Free Response 2007 Question 3 2007B Question 2 Central Limit Theorem scrapbook	S-MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. S-MD.7 Analyze decisions and strategies using probability concepts. S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. CRP11. Use technology to enhance productivity. 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	3 Lessons followed by 2 lessons of review and assessment

Unit 8 Overview
Unit Title: Confidence Intervals

Unit Summary: This unit focuses on the basic procedures for constructing confidence intervals as predictors of population parameters.
Suggested Pacing: 10 Lessons
Learning Targets
Unit Essential Questions: • What is a confidence interval? • How is a confidence interval constructed? • How do you interpret the confidence interval?
Unit Enduring Understandings: • A confidence interval is a formal inference procedure, meaning that it uses sample data to draw conclusions about a parameter. • PANIC - Population, Assumptions, Name of interval, Interval, Conclusion • "We are __% confident that the true parameter ___ is captured in the interval _____ to ______.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, confidence intervals for population mean, confidence intervals for population proportion, critical values, and margin of error. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Interpret a confidence level in context. Interpret a confidence interval in context. Understand that a confidence interval gives a range of plausible values for the parameter. Understand why each of the three inference conditions—Random, Normal, and Independent—is important. Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.	Content: Confidence intervals Point estimator Margin of error Nonresponse Undercoverage Response bias Skills: Interpreting confidence intervals Constructing confidence intervals Using confidence intervals wisely	Resources from The Practice of Statistics textbook plus "What is a confidence interval, anyway?" (Page 172 AB) AP Free Response 2002 Question 1 2002B Question 4 2003 Question 6 Partner Activity - Students will look at various confidence intervals to a certain problem and match each one with a specific confidence. Explanations must accompany. Students will then see if they can figure out where the numbers came from based off of previous knowledge.	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. MP.3 Construct viable arguments and critique the reasoning of others MP.4 Model with mathematics CRP2. Apply appropriate academic and technical skills.	3 Lessons

Construct and interpret a confidence interval for a population proportion. Determine critical values for calculating a confidence interval using a table or your calculator				
Determine the sample size required to obtain a level C confidence interval for a population proportion 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.	Content: Conditions for estimating p Standard error Skills: Constructing a confidence interval for p The four step process Choosing the right sample size	Resources from The Practice of Statistics textbook AP Free Response 2000 Question 6 2003B Question 6 2005 Question 5 2010 Question 3 2010B Question 4 Partner Activity - The Simulating Confidence Interval for a Population Proportion www.rossmanchance.com/applets Quiz Questions - "Why is sample size so important in confidence intervals?"	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. MP.2 Reason abstractly and quantitatively MP.7 Look for and make use of structure	2 Lessons
Construct and interpret a confidence interval for a population mean. Determine the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error. Carry out the steps in constructing a confidence interval for a population mean: define the parameter, check conditions, perform calculations and interpret results in context.	Content: One Sample z interval for population mean One sample t interval for population mean Standard error of sample mean Degrees of freedom T-distributions Skills: Choosing the right sample size Using the t-distributions Constructing confidence interval for population mean Using t procedure wisely	Resources from The Practice of Statistics textbook plus "Capture/Recapture" (Page 181 AB) AP Free Response 2000 Question 2 2008B Question 3 Pull a topic from www.whfreeman.com/tps4e for your students to find confidence intervals from. Technology Activity - Students will use the graphing calculators to find confidence intervals then check their work using the formulas. Students need to make sure both answers are the same, since the AP asks for both sometimes.	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. MP.3 Construct viable arguments and critique the reasoning of others MP.4 Model with mathematics 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	3 Lessons followed by 2 lessons of review and assessment

Unit 9 Overview
Unit Title: Significance Testing
Unit Summary: This unit explores the procedures for conducting hypothesis testing for one and two sample population parameters.

Suggested Pacing: 8 Lessons
Learning Targets
Unit Essential Questions: ● What does a significance test test? ● How do you determine the appropriate procedure (z or t) to use for the test? ● How do you determine which is the more serious error, Type I or Type II? ● How do you confirm that the conditions for inference are met for tests?
Unit Enduring Understandings: ● A significance test is a primary form of statistical inference that is used to determine if a statistically significant difference from the hypotheses was found. ● Determine what is being measured, proportions or means. ● Determine consequences of a Type I and Type II error in the context of the problem. ● There are criteria that must be met in order for the significance tests to have reasonable conclusions.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to,significance tests, type I and type II errors, and meeting proper conditions to perform tests. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
State correct hypotheses for significance test about a population proportion or mean. Interpret p-values in context. Interpret a Type I error and a Type II error in context, and give the consequences of each. Understand the relationship between the significance level of a test, p (Type II error), and power.	Content: Significance tests Null hypothesis Alternative hypothesis P-Value Statistically Significant Type I and II errors Skills: Reason for significance tests Stating the hypothesis Interpreting P-Values	Resources from The Practice of Statistics textbook plus “Examining Type II error through Simulation.” AP Free Response 2003 Question 1 2003 Question 2 2006B Question 6 2008B Question 4 2009 Question 6 2009B Question 4 Partner Activity - Come up with 10 scenarios that deal with significance testing. Make the Ho and the Ha and mix all together. Have students group the right Ho and Ha with	S-IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. MP.2 Reason abstractly and quantitatively MP.7 Look for and make use of structure	2 Lessons

		the appropriate example. When complete, have students come to smart board to explain.		
Check conditions for carrying out a test about a population proportion. If conditions are met, conduct a significance test about a population proportion. Use a confidence interval to draw a conclusion for a two-sided test about a population proportion.	Content: Two sided tests One-sample z test for a proportion Test statistic Skills: Carrying out a significance test for proportion	Resources from The Practice of Statistics textbook plus "Coins on Edge" (Page 212 AB) AP Free Response 1998 Question 5 Technology Activity - "The Improved Batting Average" www.rossmanchance.com/applets	S-IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. MP.3 Construct viable arguments and critique the reasoning of others MP.4 Model with mathematics CRP 8. Utilize critical thinking to make sense of problems and persevere in solving them.	2 Lessons
Check conditions for carrying out a test about a population mean. 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.	Content: One-sample t test Paired data Skills: Carrying out a significance test for population mean	Resources from The Practice of Statistics AP Free Response 1997 Question 5 1999 Question 6 2001 Question 5 2005 Question 4 2005B Question 6 2006B Question 4 2007 Question 4 2008B Question 4 2008B Question 6 2009B Question 5 Technology Activity - http://www.intuitor.com/statistics/CurveApplet.html	S-IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. MP.5 Use appropriate tools strategically CRP 11. Use technology to enhance productivity. 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	2 Lessons followed by 2 lessons of review and assessment

Unit 10 Overview

Unit Title: Comparing Two Populations

Unit Summary: In this unit, students learn how to compare the proportion of successes in two samples using both confidence intervals and significance tests. They will also learn how to use confidence intervals and significance tests to compare means and proportions from two samples.

Suggested Pacing: 9 Lessons

Learning Targets

Unit Essential Questions:

- When is it appropriate to use two sample t-procedures versus paired t-procedures?
- How do you perform inference on two populations or groups?

Unit Enduring Understandings:

- The rules governing combinations of random variables are used to perform inference on two populations or groups.
- The two sample procedure for inference follows essentially the same process as the one sample procedure for inference.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...

Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, two-sample tests, inference, verifying conditions and standard error. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Describe the characteristics of the sampling distribution of two proportions Calculate probabilities using the sampling distribution of two proportions Determine whether the conditions for performing inference are met. Construct and interpret a confidence interval to compare two proportions. Perform a significance test to compare two proportions. Interpret the results of inference procedures in a randomized experiment.	Content: Sampling distribution of a difference between two proportions Skills: Using confidence intervals and significance tests for two proportions	Resources from The Practice of Statistics textbook plus "Is Yawning Contagious?" AP Free Response 1997 Question 4 2002 Question 6 2003B Question 3 2004B Question 6 2006B Question 2 2007 Question 1 2007 Question 5 2008 Question 4 2009 Question 5 2009 Question 3 2009B Question 6 http://exploringdata.net/ Use the link to find data sets for your class. Present data and have them complete significance testing on them. Group Activity - Students will use data from www.amstat.org/censusatschool/ and test that data against data they got from the same survey. Compare the two sets and present data to teacher.	Does not align to any CCSS MP.4 Model with mathematics CRP 11. Use technology to enhance productivity.	4 Lessons
Describe the characteristics of the sampling distribution of two means Calculate probabilities using the sampling distribution of two mean Determine whether the conditions for performing inference are met. Use two-sample t procedures to compare two means based on summary statistics. Use two-sample t procedures to compare two means from raw data.	Content: Sampling distribution of a difference between two means Two-sample t statistic Skills: Using confidence intervals and significance tests for two means	Resources from The Practice of Statistics textbook plus "Statistical evidence of Discrimination" (Page 203 AB) AP Free Response 2000 Question 4 2002 Question 5 2004B Question 4 2004B Question 5 2005 Question 6 2005B Question 3 2006 Question 6 2007 Question 5 2009 Question 4 2010 Question 5 Group Activity - Find a claim that a company has made about one of its products. Come up with a way that you can test this claim to see if it is true. This needs to be	Does not align to any CCSS MP.5 Use appropriate tools strategically MP.6 Attend to precision CRP 6. Demonstrate and creativity and innovation. RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.W4. Produce clear and coherent writing in which the development,	3 Lessons followed by 2 lessons of review and assessment

Interpret standard computer output for two-sample t procedures. Perform a significance test to compare two means. Check conditions for using two-sample t procedures in a randomized experiment. Interpret the results of inference procedures in a randomized experiment.		done with the utmost accuracy. Have students compile and present data to class. Technology - "Name that Inference" Quiz on www.socrative.com	organization, and style are appropriate to task, purpose, and audience. 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. 9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences. 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including this classroom and during structured learning experiences.	

Unit 11 Overview
Unit Title: Chi-Squared and Inference for Linear Regression
Unit Summary: Students will learn to identify when a Test for Homogeneity, Independence or a Goodness of Fit test should be used and how to perform it, as well as the appropriate conclusions that can be drawn from the tests. Students will learn how to check for conditions when a chi-squared distribution is appropriate. Students will learn how to calculate expected values and what they represent, write them as a two-way table and input the data into their calculators to check their chi-squared calculations. Students will learn how to write appropriate conclusions from their findings. Also, students will learn how to test if the slope of a least squares regression line is appropriate and to find the confidence interval of the slope.
Suggested Pacing: 4 Lessons
Learning Targets
Unit Essential Questions: ● How does one determine which Chi-Square test to perform on a set of data? ● How do you perform a significance test about the slope of the population regression line?
Unit Enduring Understandings: ● Analyze the number of categories being compared as well as how the sample was taken. ● A significance test for regression is very similar to the other tests of significance.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: The assessment will contain AP MC like questions discussing, but not limited to, goodness of fit test, test for homogeneity, test for independence, significance test on population regression and transformations. The assessment will also contain multiple AP open-ended like questions that assess the same material.

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic. Check the Random, Large sample size, and Independent conditions before performing a chi- square test. Use a chi-square goodness-of-fit test to determine whether sample data are consistent with a specified distribution of a categorical variable. Examine individual components of the chi-square statistic as part of a follow-up analysis.	Content: Chi-squared distributions Chi-squared p-values Observed count Skills: Check Random, large sample and independent condition	Resources from The Practice of Statistics textbook AP Free Response 1998 Question 3 2003B Question 5 2006 Question 6 2008 Question 5 2009 Question 1 2010 Question 6 TI Activity - www.whfreeman.com/tsp4e/ "Goodness of Fit" This activity should be done in pairs.	Does not align to any CCSS MP.5 Use appropriate tools strategically MP.6 Attend to precision	2 Lessons
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. Interpret computer output for a chi-square test based on a two-way table. Examine individual components of the chi-square statistic as part of a follow-up analysis. 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.	Content: Expected counts Chi-square statistic Chi-square test for homogeneity Chi-square test for association/ independence Skills: Compare distributions of categorical variable Compare several proportions Relationship between two categorical variables Using Chi-squared tests	Resources from The Practice of Statistics textbook plus "How Typical Are Our Households' Ages?" (Page 207 AB) AP Free Response 1999 Question 2 2002B Question 6 2003 Question 5 2004 Question 5 2010B question 5	Does not align to any CCSS MP.4 Model with mathematics MP.5 Use appropriate tools strategically MP.6 Attend to precision	2 Lessons

Check conditions for performing inference about the slope of the population regression line. Interpret computer output from a least-squares regression analysis. Construct and interpret a confidence interval for the slope of the population regression line. Perform a significance test about the slope of a population regression line.	Content: Sampling distribution of population regression Condition for regression inference Skills: Estimating parameters Constructing confidence interval for the slope Performing a significance test for the slope	Resources from The Practice of Statistics textbook AP Free Response 2001 Question 6 2004B Question 1 2005B Question 5 2006 Question 2 2007 Question 6 2008 Question 6 2010B Question 6	Does not align to any CCSS	1 Lesson

Unit 12 Overview
Unit Title: AP Statistics Exam Review
Unit Summary: This unit provides the practice and preparation essential to getting students ready for the AP Statistics Exam. Students will have the opportunity to complete ample amounts of practice exercises including AP level multiple choice and open-ended problems. This unit will completely familiarize the students with the format of the test as well as test taking strategies to increase their chance at success on the exam.
Suggested Pacing: 10 lessons
Learning Targets
Unit Essential Questions: ● How do we apply our knowledge of statistics to prepare for the AP exam? ● How can we communicate our mathematical thinking clearly? ● How is a graphing calculator used as a problem solving tool?
Unit Enduring Understandings: ● Math can be communicated verbally, analytically, numerically graphically, and using technology.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: AP Exam

Objectives (Students will be able to...)	Essential Content/Skills	Suggested Assessments	Standards (NJSLS)	Pacing
Solve multiple choice questions at the level of difficulty of The College Board Advanced Placement Calculus AB Statistics Examination. Solve free response questions at the level of difficulty of The College Board Advanced Placement Statistics Examination.	Content: Multiple-choice, free-response Skills: Complete multiple choice problems testing proficiency in a wide variety of topics. Complete free-response problems demonstrating the ability to solve problems involving a more extended chain of reasoning.	Coursera: Preparing for the AP Statistics Exam https://www.coursera.org/course/apstat Previous Years AP Tests: http://apcentral.collegeboard.com/apc/members/exam/exam_information/8357.html Small Group Activity: Groups work on a selection of problems from AP Practice Books. Unit 12 Common Benchmark Assessment (Full length AP Statistics	All standards from all units.	15+ lessons

		Exam taken over several class meetings) Use socrative, edulastic.com, stats4stem sites to practice MC and FRQ questions.		

Unit 13 Overview
Unit Title: Projects and Activities to extend learning after the AP Statistics Exam
Unit Summary: This unit provides the opportunity for students to work with other classmates to collaborate on a year-end final project. Students will have the chance to build on the content and skills attained throughout the course and apply them in a presentation-based project.
Suggested Pacing: 15 lessons
Learning Targets
Unit Essential Questions: ● How do we demonstrate proficiency of statistics? ● How do we evaluate, solve and present a complex real world statistics problem?
Unit Enduring Understandings: ● Math can be represented and communicated verbally, numerically, analytically and visually.
Evidence of Learning
Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, etc...
Summative Assessment: Unit Project

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards** (NJSLS)	**Pacing**
Demonstrate and apply mastery of various statistics concepts to complete the project presented.	Content: Final project Skills: Read and understand complex real world project. Work in cooperative teams to complete project. Meet scheduled deadlines. Present project to class. Demonstrate thinking and analytical competency.	Project	Standards will depend on project completed.	15 lessons