Ledyard Public Schools
AP Statistics Curriculum

COURSE DESCRIPTION

The purpose of AP Statistics 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:

1. Exploring Data: Describing patterns and departures from patterns
2. Sampling and Experimentations: Planning and conducting a study
3. Anticipating Patterns: Exploring random phenomena using probability and simulation
4. Statistical Inference: Estimating population parameters and testing hypotheses

According to College Board, upon entering this course students are expected to have mathematical maturity and quantitative reasoning ability. *Mathematical maturity* could be defined as a complete working knowledge of the graphical and algebraic concepts through mathematical analysis, including linear, quadratic, exponential and logarithmic functions. As such, successful completion of Algebra II is a pre-requisite for enrollment.

The College Board also expects that students will learn how to leverage technology in order to explore and analyze data. As such, all students will also have access to a Ti-84 to enhance the analysis of data during classroom instruction, at home practice, and on the AP Exam. The calculator will be utilized on a daily basis throughout the course, as well as being supplemented with instruction on utilizing Google Sheets, Microsoft Excel, and other online apps to further enhance the analysis of data and create statistical displays.

COURSE TEXTBOOK

Starnes, Daren S., and Josh Tabor. The Practice of Statistics: For the AP® Exam. 6th ed., New York, Bedford, freeman & worth, 2018.

SUPPLEMENTAL RESOURCES

Bock, David E., et al. *Stats in Your World*. 2nd ed., Boston, Pearson, 2016.

Molesky, Jason M., et al. Strive for a 5: Preparing for the AP Statistics Examination : to Accompany the Practice of Statistics, Sixth Edition, Daren Starnes, Josh Tabor, Dan Yates, David Moore. New York, W. H. Freeman and Company, 2018.

Additionally, College Board Released Test Questions will be embedded within instruction and assessments. Online data resources such as Wolfram Alpha, Gallup Poll, The Connecticut Crash Data Repository, and others yet to be identified will also be sourced to provide students with relevant data to analyze.

COURSE PROJECTS

For all units of study students will complete mini-projects, referred to as performance tasks, targeting the specific skills and concepts students are learning. These performance tasks will help students develop their ability throughout the statistical process. Each performance task will require students to utilize technology in order to perform analysis of data and draw conclusions that they will be required to communicate clearly to readers. The culmination of which will be students designing, executing, analyzing, and summarizing a statistical investigation of their own choosing.

Approved by Instructional Council April 10, 2019

UNIT 1: DATA ANALYSIS

Pacing: 8 Blocks

Description	This unit will focus on the foundational skills for data analysis. Students will learn about the different types of variables that can be studied, the ways in which these variables are analyzed, and various ways to display data. Student will communicate observed patterns and summarize any conclusions that may be made from the data.
Learning Targets	Introduction ☐ Identify the individuals and variables in a set of data. ☐ Classify variables as categorical or quantitative. Section 1.1 ☐ Make and interpret bar graphs for categorical data. ☐ Identify what makes some graphs of categorical data misleading. ☐ Calculate marginal and joint relative frequencies from a two-way table. ☐ Use bar graphs to compare distributions of categorical data. ☐ Describe the nature of the association between two categorical variables. Section 1.2 ☐ Make and interpret dotplots, stemplots, and histograms of quantitative data. ☐ Identify the shape of a distribution from a graph. ☐ Describe the overall pattern (shape, center, and variability) of a distribution and identify any major departures from the pattern (outliers). ☐ Compare distributions of quantitative data using dotplots, stemplots, and histograms. Section 1.3 ☐ Calculate the measures of center (mean, median) for a distribution of quantitative data. ☐ Calculate the measures of variability (range, standard deviation, IQR) for a distribution of quantitative data. ☐ Explain how outliers and skewness affect measures of center and variability. ☐ Identify outliers using the $1.5 \times IQR$ rule. ☐ Make and interpret boxplots of quantitative data. ☐ Use boxplots and numerical summaries to compare distributions of quantitative data.
Technology Enhancements	Ti-84 Features to be embedded ☐ Create, analyze, and compare histograms and boxplots of quantitative variables. ☐ Calculate summary statistics for quantitative variables. Non-calculator Resources ☐ Google Sheets to analyze two-way tables. ☐ Google Sheets to create, analyze and compare histograms for quantitative variables. ☐ Google Sheets to calculate summary statistics for quantitative variables. ☐ One-Variable Statistical Calculator applet through the textbook
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free-Response Practice Question ☐ Categorical Variable Analysis Performance Task ☐ Quantitative Variable Analysis Performance Task

Alignments		
	Textbook	Chapter 1
	College Board	I.A.1-4, I.B.1-4, I.C.1-4, 1.E.1-4
	CCS	ID.A.1-3, ID.B.5

UNIT 2: MODELING DISTRIBUTIONS OF DATA		Pacing: 6 Blocks
Description	This unit will focus on students describing the location of an individual observation within a distribution. Students will learn how to standardize individual values, how to model a distribution with a density curve, and begin to utilize the standard Normal model.	
Learning Targets	Section 2.1 ☐ Find and interpret the percentile of an individual value in a distribution of data. ☐ Estimate percentiles and individual values using a cumulative relative frequency graph. ☐ Find and interpret the standardized score (z-score) of an individual value in a distribution of data. ☐ Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and variability of a distribution of data. Section 2.2 ☐ Use a density curve to model distributions of quantitative data. ☐ Identify the relative locations of the mean and median of a distribution from a density curve. ☐ Use the 68-95-99.7 Rule to estimate (i) the proportion of values in a specified interval, or (ii) the value that corresponds to a given percentile in a Normal distribution. ☐ Find the proportion of values in a specified interval in a Normal distribution using Table A or technology. ☐ Find the value that corresponds to a given percentile in a Normal distribution using Table A of technology. ☐ Determine whether a distribution of data is approximately Normal from graphical and numerical evidence.	
Technology Enhancements	Ti-84 Features to be embedded ☐ Examine the shape of normal distributions (normalpdf) ☐ Calculate the proportion of z-values in a specified interval (normalcdf) ☐ Calculate the z-score from a percentile (invNorm) ☐ Create, interpret, and analyze a Normal probability plot Non-calculator Resources ☐ Normal Density Curve applet through the textbook	
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free-Response Practice Question ☐ Normal Model Performance Task	
Alignments	Textbook	Chapter 2
	College Board	I.A, I.B.5, III.C.1-3
	CCS	ID.A.4

UNIT 3: DESCRIBING RELATIONSHIPS

Pacing: 7 Blocks

Description	This unit will focus on investing the relationship between two quantitative variables. Students will learn how to create, analyze, and interpret scatterplots. Students will learn how to calculate and utilize a linear regression for extrapolation; addressing the dangers of doing such. Emphasis will be placed on ensuring students' understand the differences between association, correlation, and causation.
Learning Targets	Section 3.1 ☐ Distinguish between explanatory and response variable for quantitative data. ☐ Make a scatterplot to display the relationship between two quantitative variables. ☐ Describe the direction, form, and strength of a relationship displayed in a scatterplot and identify unusual features. ☐ Interpret the correlation. ☐ Understand the basic properties of correlation, including how the correlation is influenced by outliers. ☐ Distinguish correlation from causation. Section 3.2 ☐ Make predictions using regression lines, keeping in mind the dangers of extrapolation. ☐ Calculate and interpret a residual. ☐ Interpret the slope and y-intercept of a regression line. ☐ Determine the equation of a least-squares regression line using technology or computer output. ☐ Construct and interpret residual plots to assess whether a regression model is appropriate. ☐ Interpret the standard deviation of the residuals and r^2 and use these values to assess how well a least-squares regression line models the relationship between two variables. ☐ Describe how the least-squares regression line, standard deviation of the residuals and r^2 are influenced by outliers. ☐ Find the slope and y-intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.
Technology Enhancements	Ti-84 Features to be embedded ☐ Create and analyze scatterplots. ☐ Calculate, interpret, and analyze the least-squares regression line, including correlation. ☐ Create and analyze residual plots for a linear model. Non-calculator Resources ☐ Google Sheets to create scatterplots. ☐ Google Sheets to determine a linear regression. ☐ Two Variable Statistical Calculator applet from textbook.
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free-Response Practice Question ☐ Least-squares Regression Performance Task
Alignments	Textbook: Chapter 3 College Board: I.D.1-5 CCS: ID.B.6.A-C, ID.C.7-9

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UNIT 4: COLLECTING DATA

Pacing: 7 Blocks

Description	This unit will focus on the design of statistical studies and experiments. Students will learn how to utilize random sampling techniques to complete a sample survey that is representative of the population, as well as identifying sources of bias in sampling surveys. Students will also learn about the process of experimental design for investigating the relationship between two variables.
Learning Targets	Section 4.1 ☐ Identify the population and sample in a statistical study. ☐ Identify voluntary response sampling and convenience sampling and explain how these sampling methods can lead to bias. ☐ Describe how to select a simple random sample with technology or a table of random digits. ☐ Describe how to select a sample using stratified random sampling and cluster sampling, distinguish stratified random sampling from cluster sampling, and give and advantage of each method. ☐ Explain how undercoverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias. Section 4.2 ☐ Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions ☐ Distinguish between an observational study and an experiment, and identify the explanatory and response variable in each type of study. ☐ Identify the experimental units and treatments in an experiment. ☐ Describe the placebo effect and the purpose of blinding in an experiment. ☐ Describe how to randomly assign treatments in an experiment using slips of paper, technology, or a table of random digits. ☐ Explain the purpose of comparison, random assignment, control, and replication in an experiment. ☐ Describe a completely randomized design for an experiment. ☐ Describe a randomized block design and a matched pairs design for an experiment and explain the purpose of blocking in an experiment. Section 4.3 ☐ Explain the concept of sampling variability when making an inference about a population and how sample size affects sampling variability. ☐ Explain the meaning of statistically significant in the context of an experiment and use simulation to determine if the results of an experiment were statistically significant. ☐ Identify when it is appropriate to make an inference about cause and effect. ☐ Evaluate if a statistical study has been carried out in an ethical manner.
Technology Enhancements	Ti-84 Features to be embedded ☐ Random number generation to assist in random sampling/assignment (randInt) Non-calculator Resources ☐ Online Random Number Generators (option 1, option 2, option 3) ☐ Simple Random Sample applet from the textbook.
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free Response Practice Question ☐ Sample Survey or Experimental Design Performance Task
Alignments	Textbook: Chapter 4 College Board: II.A.1-4, II.B.1-4, II.C.1-5, II.D CCS: IC.B.3, IC.B.5,

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UNIT 5: PROBABILITY		Pacing: 6 Blocks
Description	This unit will focus on the laws of probability and calculating the probability of specific events. Students will learn the definition of probability and how to simulate chance events. Students will learn how to determine if events are disjoint and independent.	
Learning Targets	Section 5.1 • Interpret probability as a long-run relative frequency. • Use simulation to model chance behavior. Section 5.2 • Give a probability model for a chance process with equally likely outcomes and use it to find the probability of an event. • Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events. • Use a two-way table or Venn diagram to model a chance process and calculate probabilities involving two events. • Apply the general addition rule to calculate probabilities. Section 5.3 • Calculate and interpret conditional probabilities. • Determine if two events are independent. • Use the general multiplication rule to calculate probabilities. • Use a tree diagram to model a chance process involving a sequence of outcomes and to calculate probabilities. • When appropriate, use the multiplication rule for independent events to calculate probabilities.	
Technology Enhancements	Ti-84 Features to be embedded • Probability Simulation App Non-calculator Resources • Probability applet through the textbook	
Assessments	Students will complete: • Formative assessments • End of Unit Assessment • AP Free Response Practice Question • Probability Performance Task	
Alignments	Textbook	Chapter 5
	College Board	III.A.1-3, III.A.5
	CCS	CP.A.1-5, CP.B.6-9

UNIT 6: RANDOM VARIABLES

Pacing: 7 Blocks

Description	This unit will continue the study of probability by focusing on probability distributions for random variables. Students will learn about discrete and continuous random variables how calculate and interpret the meaning of various statistics within these models. Students will also learn about the binomial model and geometric random variables in order to calculate the probability of various events.
Learning Targets	Section 6.1 ☐ Use the probability distribution of a discrete random variable to calculate the probability of an event. ☐ Make a histogram to display the probability distribution of a discrete random variable and describe its shape. ☐ Calculate and interpret the mean (expected value) of a discrete random variable. ☐ Calculate and interpret the standard deviation of a discrete random variable. ☐ Use the probability distribution of a continuous random variable (uniform or Normal) to calculate the probability of an event. Section 6.2 ☐ Describe the effects of adding or subtracting a constant or multiplying or dividing by a constant on the probability distribution of a random variable. ☐ Calculate the mean and standard deviation of the sum or difference of random variables. ☐ Find the probabilities involving the sum or difference of independent Normal random variables. Section 6.3 ☐ Determine whether the conditions for a binomial setting are met. ☐ Calculate and interpret the probabilities involving binomial distributions. ☐ Calculate the mean and standard deviation of a binomial random variable. Interpret these values. ☐ When appropriate, use the Normal approximation to the binomial distribution to calculate probabilities. ☐ Find probabilities involving geometric random variables.
Technology Enhancements	Ti-84 Features to be embedded ☐ Probability Simulation App ☐ Examine and analyze probability distributions (create a histogram) ☐ Calculate the mean and standard deviation of a probability model (1-Var Stats) ☐ Calculate factorials, permutations, and combinations on the calculator. ☐ Calculate a binomial probability (binompdf, binomcdf) ☐ Calculate a geometric probability (geometpdf, geometcdf) Non-calculator Resources ☐ Normal approximation to a binomial model applet through textbook.
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free Response Practice Question ☐ Random Variable Performance Task
Alignments	Textbook: Chapter 6 College Board: III.A.4, III.A.6, III.B.1-2 CCS: MD.A.1-4, MD.A.5-7

UNIT 7: INFERENCE ABOUT PROPORTIONS	Pacing: 10 Blocks
Description	This unit will begin work on statistical inference. Students will be given an overview of sampling distributions, confidence intervals, and significance testing. Students will then apply this skills specifically to sample proportions and population proportions. Students will communicate their findings and conclusions using statistical vocabulary; interpreting what their calculations represent.
Learning Targets	Section 7.1 ☐ Distinguish between a parameter and a statistic. ☐ Create a sampling distribution using all possible samples from a small population. ☐ Use the sampling distribution of a statistic to evaluate a claim about a parameter. ☐ Distinguish among the distribution of a population, the distribution of a statistic, and the sampling distribution of a statistic. ☐ Determine if a statistic is an unbiased estimator of a population parameter. ☐ Describe the relationship between sample size and the variability of a statistic. Section 7.2 ☐ Calculate the mean and standard deviation of the sampling distribution of a sample proportion $\hat{p}$ and interpret the standard deviation. ☐ Determine if the sampling distribution of $\hat{p}$ is approximately Normal. ☐ If appropriate, use a Normal distribution to calculate probabilities involving $\hat{p}$. Section 8.1 ☐ Identify an appropriate point estimator and calculate the value of a point estimate. ☐ Interpret a confidence interval in context. ☐ Determine the point estimate and margin of error from a confidence interval. ☐ Use a confidence interval to make a decision about the value of a parameter. ☐ Interpret a confidence level in context. ☐ Describe how the sample size of a confidence level affect the margin of error. Section 8.2 ☐ State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion. ☐ Determine the critical value for calculating a C% confidence interval for a population proportion using a table or technology. ☐ Construct and interpret a confidence interval for a population proportion. ☐ Determine the sample size required to obtain a C% confidence interval for a population proportion using a table or technology. Section 9.1 ☐ State appropriate hypotheses for a significance test about a population parameter. ☐ Interpret a P-value in context. ☐ Make an appropriate conclusion for a significance test. ☐ Interpret a Type I and a Type II error in context. Give a consequence of each error in a given setting. Section 9.2 ☐ State and check the Random, 10%, and Large Counts conditions for performing a significance test about a population proportion. ☐ Calculate the standardized test statistic and P-value for a test about a population proportion. ☐ Perform a significance test about a population proportion.
Technology Enhancements	Ti-84 Features to be embedded ☐ Calculate the confidence interval for a proportion (1-propZInt) ☐ Complete a one-sample z test for a proportion (1-propZTest) Non-calculator Resources ☐ Confidence interval applet from the textbook.

	☐ Reasoning of a statistical test applet from the textbook.	
Assessments	Students will complete: ☐ Formative assessments ☐ Mid-Unit Assessment ☐ End of Unit Assessment ☐ AP Free Response Practice Question ☐ Inference About Proportions Performance Task	
Alignments	Textbook	Chapters 7, 8, 9
	College Board	III.D.1-3, III.D.6, IV.A.1-4, IV.B.1-2
	CCS	IC.A.1-2, IC.B.4-6

UNIT 8: INFERENCE ABOUT MEANS

Pacing: 6 Blocks

Description	This unit will continue work on statistical inference. Students will apply the skills of sampling distributions, confidence intervals, and significance testing to sample means and population means. Students will communicate their findings and conclusions using statistical vocabulary; interpreting what their calculations represent.
Learning Targets	Section 7.3 ☐ Calculate the mean and standard deviation of the sampling distribution of a sample mean $\bar{x}$ and interpret the standard deviation. ☐ Explain how the shape of the sampling distribution of $\bar{x}$ is affected by the shape of the population distribution and the sample size. ☐ If appropriate, use a Normal distribution to calculate probabilities involving $\bar{x}$. Section 8.3 ☐ Determine the critical value for calculating a C% confidence interval for a population mean using a table or technology. ☐ State and check the Random, 10% and Normal/Large Sample conditions for constructing a confidence interval for a population mean. ☐ Construct and interpret a confidence interval for a population mean. ☐ Determine the sample size required to obtain a C% confidence interval for a population mean with a specified margin of error. Section 9.3 ☐ State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean. ☐ Calculate the standardized test statistic and P-value for a test about a population mean. ☐ Perform a significance test about a population mean. ☐ Use a confidence interval to make a conclusion about a two-sided test about a population parameter. ☐ Interpret the power of a significance test and describe what factors affect the power of a test.
Technology Enhancements	Ti-84 Features to be embedded ☐ Calculate the critical value for a confidence interval for a mean (invT) ☐ Calculate the confidence interval for a mean (TInterval) ☐ Computing p-values from a t-distribtuion (tcdf) ☐ Complete a one-sample t-test for the mean (T-Test) Non-calculator Resources ☐ Statistical Power applet through textbook.
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free Response Practice Question ☐ Inference About Means Performance Task
Alignments	Textbook: Chapters 7, 8, 9 College Board: III.D.7, IV.A.7, IV.B.4-5 CCS: IC.A.1-2, IC.B.4-6

UNIT 9: COMPARNG TWO POPULATIONS OR GROUPS		Pacing: 7 Blocks
Description	This unit will focus on statistical inference for the difference between two groups. Students will revisit sampling distributions, confidence intervals, and significance test. However, this time students will be examining the difference between sample/population proportions or sample/population means.	
Learning Targets	<u>Section 10.1</u> ☐ Describe the shape, center, and variability of the sampling distribution of $\hat{p}_1 - \hat{p}_2$ ☐ Determine whether the conditions are met for doing inference about a difference between two proportions. ☐ Construct and interpret a confidence interval for a difference between two proportions. ☐ Perform a significance test about a difference between two proportions. <u>Section 10.2</u> ☐ Describe the shape, center, and variability of the sampling distribution of $\bar{x}_1 - \bar{x}_2$ ☐ Determine whether the conditions are met for doing inference about a difference between two means. ☐ Construct and interpret a confidence interval for a difference between two means. ☐ Calculate the standardized test statistic and P-value for a test about a difference between two means. ☐ Perform a significance test about a difference between two means. <u>Section 10.3</u> ☐ Analyze the distribution of difference in a paired data set using graphs and summary statistitics. ☐ Construct and interpret a confidence interval for a mean difference. ☐ Perform a significance test about a mean difference. ☐ Determine when it is appropriate to use paired *t* procedures versus two-sample *t* procedures.	
Technology Enhancements	<u>Ti-84 Features to be embedded</u> ☐ Calculate a confidence interval for a difference in proportions (2-PropZInt) ☐ Complete a significance test for a difference in proportions (2-PropZTest) ☐ Calculate a two sample *t* interval (2-SampTInt) ☐ Complete a two sample *t* Test (2-SampTTest) <u>Non-calculator Resources</u> n/a	
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free Response Practice Problem ☐ Comparing Two Groups Performance Task	
Alignments	Textbook	Chapter 10
	College Board	III.D.4-5, IV.A.5, IV.A.7, IV.B.3, IV.B.5
	CCS	n/a

UNIT 10: INFERENCE FOR CATEGORCAL VARIABLES

Pacing: 8 Blocks

Description	In this unit, students will apply statistical inference to categorical variables. Students will learn how to apply chi-square tests to single events as well as two-way tables, drawing connections back to earlier topics in probability, such as conditional distributions and independence.
Learning Targets	<u>Section 11.1</u> ☐ State appropriate hypotheses and compute the expected counts and chi-square test statistic for a chi-square test for goodness of fit. ☐ State and check the Random, 10%, and Large Counts conditions for performing a chi-square test for goodness of fit. ☐ Calculate the degrees of freedom and P-value for a chi-square test for goodness of fit. ☐ Perform a chi-square test for goodness of fit. ☐ Conduct follow-up analysis when the result of a chi-square test are statistically significant. <u>Section 11.2</u> ☐ State appropriate hypotheses and compute the expected counts and chi-square test statistic for a chi-square test based on data in a two-way table. ☐ State and check the Random, 10%, and Large Counts conditions for a chi-square test based on data in a two way table. ☐ Calculate the degrees of freedom and P-value of a chi-square test based on data in a two-way table. ☐ Perform a chi-square test for homogeneity. ☐ Perform a chi-square test for independence. ☐ Choose the appropriate chi-square test in a given setting. ☐ Conduct follow-up analysis when the result of a chi-square test are statistically significant.
Technology Enhancements	<u>Ti-84 Features to be embedded</u> ☐ Finding P-values for chi-square tests (χ^2cdf) ☐ Chi-square test for goodness of fit (χ^2GOF-Test) ☐ Chi-square tests for two way tables (matrices & χ^2-Test) <u>Non-calculator Resources</u> n/a
Assessments	Students will complete: ☐ Formative assessments ☐ End of Unit Assessment ☐ AP Free Response Practice Problem ☐ Inference About Categorical Variables Performance Task

Alignments		
	Textbook	Chapters 11
	College Board	III.D.8, IV.B.6
	CCS	n/a

UNIT 11: MORE ABOUT REGRESSIONS	Pacing: 8 Blocks

Description

In this unit, students will apply statistical inference to linear regressions. Students will learn how to apply confidence intervals and significance testing to the slope of a linear regression. Students will also learn how to apply transformations to non-linear relations in order to find a curve that models that data.

Learning Targets

Section 12.1

- Check the conditions for performing inference about the slope β_1 of the population (true) regression line.
- Interpret the values of b_o, b_1, s, and SE_{b_1} in context, and determine these values from compute output.
- Construct and interpret a confidence interval for the slope β_1 of the population (true) regression line.
- Perform a significance test about the slope β_1 of the population (true) regression line.

Section 12.2

- Use transformations involving powers and roots to find a power model that describes the relationship between two quantitative variables, and use the model to make predictions.
- Use transformations involving logarithms to find a power model that describes the relationship between two quantitative variables, and use the model to make predictions.
- Use transformations involving logarithms to find an exponential model that describes the relationship between two quantitative variables, and use the model to make predictions.
- Determine which of several transformations does a better job of producing a linear relationship.

Technology Enhancements

Ti-84 Features to be embedded

- Calculate a confidence interval for the slope of a regression (LinRegTInt)
- Perform a significance test from the slope of a regression (LinRegTInt)
- Transforming to achieve linearity

Non-calculator Resources

n/a

Assessments

Students will complete:

- Formative assessments
- End of Unit Assessment
- AP Free Response Practice Question
- Inference About Regressions Performance Task

Alignments

Textbook	Chapters 12
College Board	IV.A.8, IV.B.7
CCS	n/a

Following the AP Exam,

UNIT 12: FINAL PROJECT		Pacing: 7 Blocks
Description	In pairs or groups of three students will choose a topic of interest to investigate. Students will then, • Identify the question(s) that they intend to analyze. • Design either a sample survey or experiment in order to collect data for statistical analysis. • Execute their sample survey or experiment in order to collect data for analysis. • Analyze the data they have collected, including all statistical inference that may be appropriate. • Summarize any conclusions they reach through their statistical analysis. • Students will identify any further questions that arise from their initial investigation. • Students will present their finds to a group through a medium of their choosing (oral presentation, WeVideo, written report, poster, etc.)	
Learning Targets	Synthesis of the learning objectives throughout the course. Varies with each project.	
Technology Enhancements	Varies with each project	
Assessments	Students will complete final product that describes their project. This final product may be in a format of their choosing including, but not limited to, a written report, oral presentation, news broadcast, etc. This include demonstration of the requirements above.	
Alignments	Textbook	Varies with each project
	College Board	Varies with each project
	CCS	Varies with each project

Appendix A: College Board Topic Outline

I. Exploring data: describing patterns and departures from patterns (20%–30%)

A. Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)
1. Center and spread
2. Clusters and gaps
3. Outliers and unusual features
4. Shape

B. Summarizing distributions of univariate data
1. Measuring center: median, mean
2. Measuring spread: range, interquartile range, standard deviation
3. Measuring position: quartiles, percentiles, standardized scores (*z*-scores)
4. Using boxplots
5. The effect of changing units on summary measures

C. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
1. Comparing center and spread
2. Comparing clusters and gaps
3. Comparing outliers and unusual features
4. Comparing shape

D. Exploring bivariate data
1. Analyzing patterns in scatterplots
2. Correlation and linearity
3. Least-squares regression line
4. Residual plots, outliers, and influential points
5. Transformations to achieve linearity: logarithmic and power transformations

E. Exploring categorical data
1. Frequency tables and bar charts
2. Marginal and joint frequencies for two-way tables
3. Conditional relative frequencies and association
4. Comparing distributions using bar charts

II. Sampling and experimentation: planning and conducting a study (10%–15%)

A. Overview of methods of data collection
1. Census
2. Sample survey
3. Experiment
4. Observational study

B. Planning and conducting surveys
1. Characteristics of a well-designed and well-conducted survey
2. Populations, samples, and random selection
3. Sources of bias in sampling and surveys
4. Sampling methods, including simple random sampling, stratified random sampling, and cluster sampling

C. Planning and conducting experiments
1. Characteristics of a well-designed and well-conducted experiment
2. Treatments, control groups, experimental units, random assignments, and replication
3. Sources of bias and confounding, including placebo effect and blinding
4. Completely randomized design
5. Randomized block design, including matched pairs design

D. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments, and surveys

III. Anticipating patterns: exploring random phenomena using probability and simulation (20%–30%)

A. Probability
1. Interpreting probability, including long-run relative frequency interpretation
2. "Law of large numbers" concept
3. Addition rule, multiplication rule, conditional probability, and independence
4. Discrete random variables and their probability distributions, including binomial and geometric
5. Simulation of random behavior and probability distributions
6. Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable

B. Combining independent random variables
1. Notion of independence versus dependence
2. Mean and standard deviation for sums and differences of independent random variables

C. The Normal distribution
1. Properties of the Normal distribution
2. Using tables of the Normal distribution
3. The Normal distribution as a model for measurements

D. Sampling distributions
1. Sampling distribution of a sample proportion
2. Sampling distribution of a sample mean
3. Central limit theorem
4. Sampling distribution of a difference between two independent sample proportions
5. Sampling distribution of a difference between two independent sample means
6. Simulation of sampling distributions
7. *t* distribution
8. Chi-square distribution

IV. Statistical inference: estimating population parameters and testing hypotheses (30%–40%)

A. Estimation (point estimators and confidence intervals)
1. Estimating population parameters and margins of error
2. Properties of point estimators, including unbiasedness and variability
3. Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
4. Large-sample confidence interval for a proportion
5. Large-sample confidence interval for a difference between two proportions
6. Confidence interval for a mean
7. Confidence interval for a difference between two means (unpaired and paired)
8. Confidence interval for the slope of a least-squares regression line

B. Tests of significance
1. Logic of significance testing, null and alternative hypotheses; *P*-values; one-and two-sided tests; concepts of Type I and Type II errors; concept of power
2. Large-sample test for a proportion
3. Large-sample test for a difference between two proportions
4. Test for a mean
5. Test for a difference between two means (unpaired and paired)
6. Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)
7. Test for the slope of a least-squares regression line

Appendix B: College Board Formula Sheet

I. Descriptive Statistics

$$\bar{x} = \frac{\sum x_i}{n}$$

$$s_x = \sqrt{\frac{1}{n-1}\sum (x_i - \bar{x})^2}$$

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 - 1) + (n_2 - 1)}}$$

$$\hat{y} = b_0 + b_1 x$$

$$b_1 = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sum (x_i - \bar{x})^2}$$

$$b_0 = \bar{y} - b_1 \bar{x}$$

$$r = \frac{1}{n-1}\sum \left(\frac{x_i - \bar{x}}{s_x}\right)\left(\frac{y_i - \bar{y}}{s_y}\right)$$

$$b_1 = r\frac{s_y}{s_x}$$

$$s_{b_1} = \frac{\sqrt{\frac{\sum (y_i - \hat{y}_i)^2}{n-2}}}{\sqrt{\sum (x_i - \bar{x})^2}}$$

II. Probability

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$E(X) = \mu_x = \sum x_i p_i$$

$$Var(X) = \sigma_x^2 = \sum (x_i - \mu_x)^2 p_i$$

If X has a binomial distribution with parameters n and p, then:

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

$$\mu_x = np$$

$$\sigma_x = \sqrt{np(1-p)}$$

$$\mu_{\hat{p}} = p$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

If $\bar{x}$ is the mean of a random sample of size n from an infinite population with mean μ and standard deviation σ, then:

$$\mu_{\bar{x}} = \mu$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

III. Inferential Statistics

Standardized test statistic: $\dfrac{\text{statistic} - \text{parameter}}{\text{standard deviation of statistic}}$

Confidence interval: statistic $\pm$ (critical value) $\cdot$ (standard deviation of statistic)

Single-Sample

Statistic	Standard Deviation of Statistic
Sample Mean	$\frac{\sigma}{\sqrt{n}}$
Sample Proportion	$\sqrt{\frac{p(1-p)}{n}}$

Two-Sample

Statistic	Standard Deviation of Statistic
Difference of sample means	$\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$ Special case when $\sigma_1 = \sigma_2$ $\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$
Difference of sample proportions	$\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$ Special case when $p_1 = p_2$ $\sqrt{p(1-p)}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

Chi-square test statistic = $\sum \dfrac{(\text{observed} - \text{expected})^2}{\text{expected}}$

Appendix B: College Board Tables

Table entry for z is the probability lying below z.

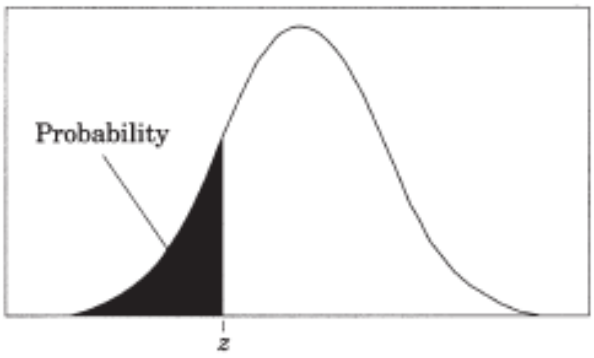

Table A Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Table entry for z is the probability lying below z.

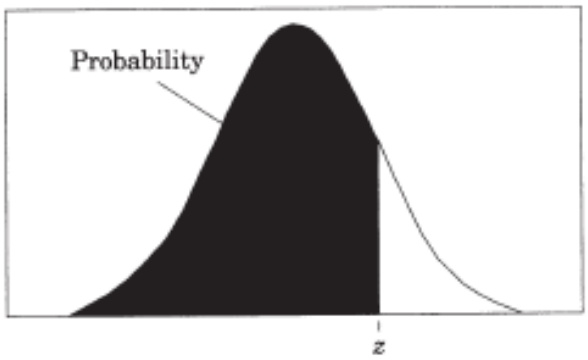

Table A *(Continued)* Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Table entry for p and C is the point t^* with probability p lying above it and probability C lying between $-t^*$ and t^*.

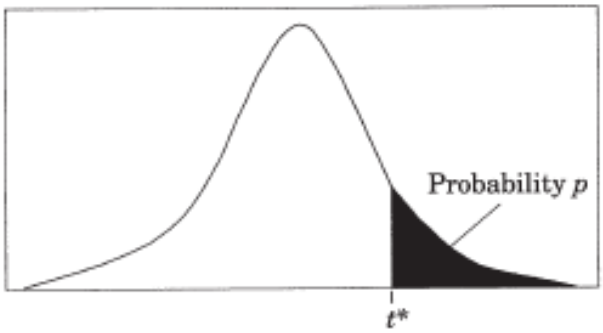

Table B

t distribution critical values

	Tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	.679	.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	.679	.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	.678	.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	.677	.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	.675	.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	.674	.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											

Table entry for p is the point (χ^2) with probability p lying above it.

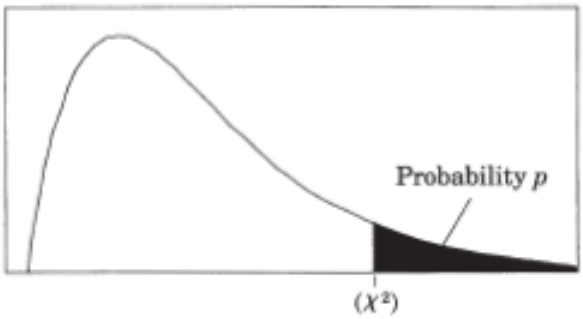

Table C

χ^2 critical values

	Tail probability p										
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001
1	1.32	1.64	2.07	2.71	3.84	5.02	5.41	6.63	7.88	9.14	10.83
2	2.77	3.22	3.79	4.61	5.99	7.38	7.82	9.21	10.60	11.98	13.82
3	4.11	4.64	5.32	6.25	7.81	9.35	9.84	11.34	12.84	14.32	16.27
4	5.39	5.99	6.74	7.78	9.49	11.14	11.67	13.28	14.86	16.42	18.47
5	6.63	7.29	8.12	9.24	11.07	12.83	13.39	15.09	16.75	18.39	20.51
6	7.84	8.56	9.45	10.64	12.59	14.45	15.03	16.81	18.55	20.25	22.46
7	9.04	9.80	10.75	12.02	14.07	16.01	16.62	18.48	20.28	22.04	24.32
8	10.22	11.03	12.03	13.36	15.51	17.53	18.17	20.09	21.95	23.77	26.12
9	11.39	12.24	13.29	14.68	16.92	19.02	19.68	21.67	23.59	25.46	27.88
10	12.55	13.44	14.53	15.99	18.31	20.48	21.16	23.21	25.19	27.11	29.59
11	13.70	14.63	15.77	17.28	19.68	21.92	22.62	24.72	26.76	28.73	31.26
12	14.85	15.81	16.99	18.55	21.03	23.34	24.05	26.22	28.30	30.32	32.91
13	15.98	16.98	18.20	19.81	22.36	24.74	25.47	27.69	29.82	31.88	34.53
14	17.12	18.15	19.41	21.06	23.68	26.12	26.87	29.14	31.32	33.43	36.12
15	18.25	19.31	20.60	22.31	25.00	27.49	28.26	30.58	32.80	34.95	37.70
16	19.37	20.47	21.79	23.54	26.30	28.85	29.63	32.00	34.27	36.46	39.25
17	20.49	21.61	22.98	24.77	27.59	30.19	31.00	33.41	35.72	37.95	40.79
18	21.60	22.76	24.16	25.99	28.87	31.53	32.35	34.81	37.16	39.42	42.31
19	22.72	23.90	25.33	27.20	30.14	32.85	33.69	36.19	38.58	40.88	43.82
20	23.83	25.04	26.50	28.41	31.41	34.17	35.02	37.57	40.00	42.34	45.31
21	24.93	26.17	27.66	29.62	32.67	35.48	36.34	38.93	41.40	43.78	46.80
22	26.04	27.30	28.82	30.81	33.92	36.78	37.66	40.29	42.80	45.20	48.27
23	27.14	28.43	29.98	32.01	35.17	38.08	38.97	41.64	44.18	46.62	49.73
24	28.24	29.55	31.13	33.20	36.42	39.36	40.27	42.98	45.56	48.03	51.18
25	29.34	30.68	32.28	34.38	37.65	40.65	41.57	44.31	46.93	49.44	52.62
26	30.43	31.79	33.43	35.56	38.89	41.92	42.86	45.64	48.29	50.83	54.05
27	31.53	32.91	34.57	36.74	40.11	43.19	44.14	46.96	49.64	52.22	55.48
28	32.62	34.03	35.71	37.92	41.34	44.46	45.42	48.28	50.99	53.59	56.89
29	33.71	35.14	36.85	39.09	42.56	45.72	46.69	49.59	52.34	54.97	58.30
30	34.80	36.25	37.99	40.26	43.77	46.98	47.96	50.89	53.67	56.33	59.70
40	45.62	47.27	49.24	51.81	55.76	59.34	60.44	63.69	66.77	69.70	73.40
50	56.33	58.16	60.35	63.17	67.50	71.42	72.61	76.15	79.49	82.66	86.66
60	66.98	68.97	71.34	74.40	79.08	83.30	84.58	88.38	91.95	95.34	99.61
80	88.13	90.41	93.11	96.58	101.9	106.6	108.1	112.3	116.3	120.1	124.8
100	109.1	111.7	114.7	118.5	124.3	129.6	131.1	135.8	140.2	144.3	149.4

Appendix C: Content Specific Vocabulary (by Unit)

Unit 1	$1.5 \times IQR$ rule for outliers, association, back-to-back stemplot, bar graph, bimodal, boxplot, categorical variable, conditional distribution, conditional relative frequencies, data analysis, distribution, dotplot, first quartile (Q_1), five-number summary, frequency table, histogram, individual, inference, interquartile range (IQR), joint relative frequencies, marginal relative frequencies, mean, median, outlier, pie chart, quantitative variable, quartiles, range, relative frequency table, resistant, round off error, segmented bar graph, side-by-side bar graph, skewed, standard deviation (s_x), statistics, stemplot, symmetric, third quartile (Q_3), two-way table, uniform distribution, unimodal, variable, variance ($s^2{}_x$)
Unit 2	68-95-99.7 Rule, Chebyshev's inequality, cumulative relative frequency graph, density curve, mean of a density curve, median of a density curve, Normal curve, Normal distribution, Normal probability plot, outlier, percentile, standard Normal distribution, standard Normal table (Table A), standardized score (z-score)
Unit 3	coefficient of determination (r^2), correlation (r), explanatory variable, extrapolation, influential observation, least-squares regression line, negative association, outlier in regression, positive association, predicted value, regression line, residual plot, residuals, response variable, scatterplot, slope, standard deviation of the residuals (s), y-intercept
Unit 4	anonymity, bias, block, census, cluster sampling, comparison, completely randomized design, confidential, confounding, control, control group, convenience sampling, double-blind, experimental unit, experiments, factor, inference, inference about a population, inference about cause and effect, informed consent, institutional review board, level, margin of error, matched pairs design, nonresponse, observational study, placebo, placebo effect, population, random assignment, random sampling, randomized block design, replication, response bias, sample, sample survey, sampling variability, simple random sample, single-blind, statistically significant, stratified random sampling, subjects, treatment, undercoverage, voluntary response sampling, wording of questions
Unit 5	addition rule for mutually exclusive events, complement, complement rule, conditional probability, event, general addition rule, general multiplication rule, independent events, intersection, law of large numbers, multiplication rule for independent events, mutually exclusive, probability, probability model, sample space, simulation, tree diagram, union, Venn diagram
Unit 6	10% condition, binomial distribution, binomial random variable, binomial setting, continuous random variable, discrete random variable, factorial, geometric distribution, geometric probability formula, geometric random variable, geometric setting, independent random variables, Large Counts condition, mean (expected value) of a discrete random variable, Normal approximation to a binomial distribution, probability distribution, random variable, standard deviation of a discrete

	random variable, variance of a discrete random variable
Unit 7 and Unit 8	alternative hypothesis H_a, biased estimator, central limit theorem (CLT), confidence interval, confidence level C, critical value, fail to reject H_o, margin of error, Normal/Large sample condition, null hypothesis H_o, one-sample t interval for a mean, one-sample t test for a mean, one-sample z interval for a proportion, one-sample z test for a proportion, one-sided alternative hypothesis, P-value, parameter, point estimate, point estimator, power, random condition, reject H_o, sampling distribution, sampling distribution of the sample mean, sampling distribution of the sample proportion, sampling variability, significance level, significance test, standard error standardized test statistic, statistic, statistically significant, t distribution, two-sided alternative hypothesis, Type I error, Type II error, unbiased estimator, variability of a statistic
Unit 9	one sample t interval for a mean difference, paired data, paired t interval for a mean difference, paired t test for a mean difference, pooled or combined sample proportion, randomization distribution, sampling distribution of $\hat{p}_1 - \hat{p}_2$, sampling distribution of $\bar{x}_1 - \bar{x}_2$, two-sample t interval for a difference between two means, two-sample t test for the difference between two means, two-sample z interval for the difference between two proportions, two-sample z test for the difference between two proportions
Unit 10	chi-squared distribution, chi-squared test for goodness of fit, chis-squared test for homogeneity, chi-squared test for independence, chi-squared statistic, components, expected counts, Large Counts condition for chi-squared test, multiple comparisons, observed counts, one-way table
Unit 11	exponential model, population (true) regression line, power model, sample regression line (estimated regression line), sampling distribution of a slope b_1, t interval for the slope B, t test for the slope, transforming