Mathematics Department

AP Statistics

Developed By: Takisha Sanchez
Effective Date:

Scope and Sequence

Unit	Topic of Study	Duration (Weeks Taught)
1	Exploring One-Variable Data and Collecting Data	7 weeks
2	Probability, Random Variables, and Probability Distributions	5.5 weeks
3	Inference for Categorical Data: Proportions	7.5 weeks
4	Inference for Quantitative Data: Means	6 weeks
5	Regression Analysis	2 weeks

Unit 1
Exploring One-Variable Data and Collecting Data
Summary and Rationale
In Unit 1, students identify components and formulate investigative questions of a statistical study, define and represent categorical and quantitative variables, describe and compare distributions of one-variable data, interpret statistical calculations to assess claims about individual data points or samples, and justify the use of important principles of sampling and experimental design. Students also learn to talk about data in real-world contexts. Variability in data may suggest certain conclusions about the data distribution, but not all variation is meaningful. Statistics allow us to develop shared understandings of uncertainty and variation. Additionally, students learn that, depending on how data are collected, they may or may not be able to generalize findings or establish evidence of causal relationships. For example, if random selection is not used to obtain a sample from a population, bias may result and statistics from the sample could not be assumed to generalize to the population. For data collected using well-designed experiments, statistically significant differences between

or among experimental treatment groups are evidence that the treatments caused the effect.

Recommended Pacing

7 Weeks

Standards

HSS-ID.A.1 Represent data with plots on the real number line, including dot plots, histograms, and box plots.
HSS-ID.A.2 Use appropriate statistics to compare center and spread of data sets.
HSS-ID.A.3 Interpret differences in shape, center, and spread, accounting for possible outliers.
HSS-ID.A.4 Use mean and standard deviation to fit data to a normal distribution and estimate percentages.
HSS-ID.B.5 Summarize categorical data using two-way frequency tables and interpret relative frequencies.
HSS-IC.B.3 Recognize the purposes and differences among sample surveys, experiments, and observational studies.
HSS-IC.B.6 Evaluate reports based on data.

Interdisciplinary Connections

- Natural & Health Sciences: Students examine experimental design principles (e.g., control groups, blinding, and placebos) which directly mimic clinical drug trials, medical research, and AP Biology laboratory configurations.
- Social Sciences & Psychology: Designing bias-free surveys, understanding confounding variables, and collecting data on human behavior directly support experimental methodologies in AP Psychology and Sociology.
- Civics & Government: Analyzing sampling methods and potential biases helps students critically evaluate public opinion polls, census data, and demographic trends in political science.

Instructional Focus

Unit Essential Questions:

- How can we use data to tell a story?
- What visual representations best highlight the unique patterns or deviations within a single dataset?
- How do we design a study or experiment so that the conclusions we draw are actually valid and ethical?
- What strategies can minimize bias when gathering observations from a population?

Unit Enduring Understandings:

- EU: UNC (Unifying Concepts / Variation and Distribution): Displaying, summarizing, and comparing distributions of data allows us to identify patterns, skewness, outliers, and fundamental variation.
- EU: VAR (Data Collection / Sampling and Experimentation): The method of data collection determines whether conclusions can be generalized to a larger population or whether a causal relationship can be inferred.

Evidence of Learning (Assessments)

Assign the Progress Checks from AP Course and Exam Description Resource for each unit.
Each Personal Progress Check contains formative multiple-choice and free-response questions.
The feedback from the Personal Progress Checks shows students the areas where they need to focus.

Objectives (SLO)

Topic	Skills	Class Periods ~26 CLASS PERIODS
1.1 Introducing Statistics: What Can We Learn from Data?	1.A Determine a valid investigative question that requires a statistical investigation. 2.A Identify information to answer a question or solve a problem.	2
1.2 Variables	2.A Identify information to answer a question or solve a problem.	1
1.3 Tabular Representation and Summary Statistics for One Categorical Variable	3.A Construct tabular and graphical representations of data and distributions. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics.	2
1.4 Graphical Representations for One Categorical Variable	3.A Construct tabular and graphical representations of data and distributions. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	2
1.5 Graphical Representations for One Quantitative Variable	3.A Construct tabular and graphical representations of data and distributions.	2
1.6 Descriptions for One Quantitative Variable Distributions	4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	2
1.7 Summary Statistics for One Quantitative Variable	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	2
1.8 Graphical Representations of Summary Statistics for One Quantitative Variable	3.A Construct tabular and graphical representations of data and distributions. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics.	2

1.9 Comparisons of the Distributions for One Quantitative Variable	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results. 4.C Describe distributions and compare relative positions of points within a distribution.	2
1.10 The Investigative Question Revisited and Data Collection	1.A Determine a valid investigative question that requires a statistical investigation. 2.A Identify information to answer a question or solve a problem. 2.B Justify an appropriate method for ethically gathering and representing data.	2
1.11 Random Sampling	2.A Identify information to answer a question or solve a problem. 2.B Justify an appropriate method for ethically gathering and representing data.	2
1.12 Potential Problems with Sampling	2.A Identify information to answer a question or solve a problem.	2
1.13 Experimental Design	2.A Identify information to answer a question or solve a problem. 2.B Justify an appropriate method for ethically gathering and representing data.	3

Suggested Resources/Technology Tools

College Board AP Website

Modifications

Special Education-

Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.

- Allow additional time for skill mastery.
- Provide small group/ individualized instruction.
- Allow use of assistive technology.
- Anticipate needs; pre-teach if needed.
- Have student repeat directions to check for understanding.
- Highlight text/ visual presentation.
- Modify assessment/assignment content, format, length (benchmarks, tests and quizzes) .

ML-

- Provide additional wait time for student responses to questions
- Provide simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase.
- Speak clearly, using a normal tone and rate of speed, or slightly slower.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading

Gifted and Talented-

● Advance, accelerate, or compact content
● Support abstract and advanced higher-level thinking through differentiated questioning
● Allowance for adapting of content for individual student interests
● Provide assignments geared to development in areas of affect, creativity, cognition, and research skills

504-

Modifications and accommodations must be aligned to the 504 plan and uphold expectations of the plan lawfully.

● Provide additional time for in-class assignments and assessments
● Allow for computer with voice output, spelling and grammar checker
● Offer individual help throughout the lesson
● Modify readings and primary source documents

At Risk-

● Provide small group instruction for identified areas for growth
● Allow for alternate pathways for completion of assignments.
● Provide additional wait time for student responses to questions
● Pair oral instruction with visuals
● Utilize manipulatives

For a full list of Accommodations and Modifications, please click here.

Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

Please select all standards that apply to this unit of study:

- ☑ Act as a responsible and contributing citizen and employee.
- ☑ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☑ Communicate clearly and effectively and with reason.
- ☐ Consider the environmental, social and economics impacts of decisions.
- ☐ Demonstrate creativity and innovation.
- ☑ Employ valid and reliable research strategies.
- ☑ Utilize critical thinking to make sense of problems and persevere in solving them.
- ☐ Model integrity, ethical leadership, and effective management.
- ☐ Plan education and career paths aligned to personal goals.
- ☐ Use technology to enhance productivity.
- ☐ Work productively in teams while using cultural global competence.

Unit 2
Probability, Random Variables, and Probability Distributions
Summary and Rationale
In this unit, students explore relationships in two-variable categorical data sets that will help them understand some of the rules of probability. Probabilistic reasoning allows statisticians to quantify the likelihood of random events over the long run and make statistical inferences. Simulations and concrete examples can help students understand the abstract definitions and calculations of probability. This unit builds on understandings of simulated or empirical data distributions and fundamental principles of probability to represent, interpret, and calculate parameters for theoretical probability distributions for discrete random variables. When students interpret probabilities and parameters associated with a probability distribution, they are expected to use appropriate units and relate to the context of the situation. This unit also introduces the standard normal distribution, including the empirical rule, sampling distribution of a statistic, and the central limit theorem (CLT).
Recommended Pacing
5.5 Weeks
Standards
HSS-CP.A.1 Describe events using unions, intersections, and complements. HSS-CP.A.2 Understand independence and use multiplication of probabilities to determine independence. HSS-CP.A.3 Understand conditional probability and its relationship to independence. HSS-CP.A.4 Construct and interpret two-way frequency tables to determine independence and conditional probabilities. HSS-CP.A.5 Recognize and explain conditional probability and independence in everyday situations. HSS-CP.B.6 Find and interpret conditional probabilities. HSS-CP.B.7 Apply the Addition Rule to calculate probabilities of compound events. HSS-CP.B.8 Apply the general Multiplication Rule. HSS-MD.A.1 Define a random variable and graph its probability distribution. HSS-MD.A.2 Calculate and interpret the expected value of a random variable. HSS-MD.A.3 Develop theoretical probability distributions and calculate expected values. HSS-MD.A.4 Develop empirical probability distributions and calculate expected values. HSS-MD.B.5 Evaluate possible outcomes of decisions using probabilities and expected values. HSS-ID.B.5 Summarize categorical data using two-way frequency tables and interpret relative frequencies. HSS-IC.A.2 Determine whether a probability model is consistent with observed results using simulation. HSS-MD.B.6 Use probabilities to make fair decisions. HSS-MD.B.7 Analyze decisions and strategies using probability concepts.
Interdisciplinary Connections

- Biology & Genetics: Conditional probability and independent events form the exact mathematical basis for predicting genetic inheritance patterns (Mendelian genetics, Punnett squares, and Hardy-Weinberg equilibrium) in AP Biology. [1]
- Finance & Insurance: Random variables and expected values are used to calculate risk assessment, insurance premiums, financial market variations, and games of chance. [1, 2]
- Earth & Environmental Science: Probability models allow students to assess environmental risks, such as calculating the likelihood of extreme weather events, natural disasters, or pollution levels over time.

Instructional Focus

Unit Essential Questions:

- How can simulation or mathematical models help us predict outcomes in random events?
- What defines a "rare event," and how do probability rules allow us to quantify its likelihood?
- How do the mean and standard deviation of a random variable change when we combine or scale data?

Unit Enduring Understandings:

- EU: UNC (Randomness and Probability): Probability models describe long-run relative frequency and provide the foundation for quantifying uncertainty and understanding sampling distributions.
- EU: VAR (Random Variables): Combining or transforming random variables affects their expected values and standard deviations in predictable ways.

Evidence of Learning (Assessments)

Assign the Progress Checks from AP Course and Exam Description Resource for each unit.
Each Personal Progress Check contains formative multiple-choice and free-response questions.
The feedback from the Personal Progress Checks shows students the areas where they need to focus.

Objectives (SLO)

Topic	Skills	~24 CLASS PERIODS
2.1 Tabular and Graphical Representations for the Distributions of Two Categorical Variables	4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	2
2.2 Summary Statistics for Two Categorical Variables	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	1
2.3 Estimating Probabilities Using Simulation	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals.	1
2.4 Introduction to Probability	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals.	2
2.5 Mutually Exclusive Events	4.B Justify a claim based on statistical calculations and results.	2
2.6 Conditional Probability	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals.	2
2.7 Independent Events and Unions of Events	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals.	2
2.8 Introduction to Random Variables and Probability Distributions	3.A Construct tabular and graphical representations of data and distributions.	2
2.9 Parameters of Random Variables	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.D Interpret statistical calculations and results to assess meaning or a claim.	2
2.10 The Binomial Distribution	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals. 3.D Calculate means, standard deviations, and parameters for probability distributions. 4.B Justify a claim based on statistical calculations and results. 4.D Interpret statistical calculations and results to assess meaning or a claim.	2

2.11 The Normal Distribution	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals. 3.D Calculate means, standard deviations, and parameters for probability distributions. 4.C Describe distributions and compare relative positions of points within a distribution.	3
2.12 Sampling Distributions and the Central Limit Theorem	4.C Describe distributions and compare relative positions of points within a distribution.	3

Suggested Resources/Technology Tools

College Board AP Website

Modifications

Special Education-
Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.
- Allow additional time for skill mastery.
- Provide small group/ individualized instruction.
- Allow use of assistive technology.
- Anticipate needs; pre-teach if needed.
- Have student repeat directions to check for understanding.
- Highlight text/ visual presentation.
- Modify assessment/assignment content, format, length (benchmarks, tests and quizzes) .

ML-
- Provide additional wait time for student responses to questions
- Provide simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase.
- Speak clearly, using a normal tone and rate of speed, or slightly slower.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading

Gifted and Talented-
- Advance, accelerate, or compact content
- Support abstract and advanced higher-level thinking through differentiated questioning
- Allowance for adapting of content for individual student interests
- Provide assignments geared to development in areas of affect, creativity, cognition, and research skills

504-
Modifications and accommodations must be aligned to the 504 plan and uphold expectations of the plan lawfully.
- Provide additional time for in-class assignments and assessments
- Allow for computer with voice output, spelling and grammar checker
- Offer individual help throughout the lesson
- Modify readings and primary source documents

At Risk-
- Provide small group instruction for identified areas for growth
- Allow for alternate pathways for completion of assignments.

● Provide additional wait time for student responses to questions
● Pair oral instruction with visuals
● Utilize manipulatives

For a full list of Accommodations and Modifications, please click here.

Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

Please select all standards that apply to this unit of study:

- ☐ Act as a responsible and contributing citizen and employee.
- ☑ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☑ Communicate clearly and effectively and with reason.
- ☐ Consider the environmental, social and economics impacts of decisions.
- ☑ Demonstrate creativity and innovation.
- ☑ Employ valid and reliable research strategies.
- ☑ Utilize critical thinking to make sense of problems and persevere in solving them.
- ☐ Model integrity, ethical leadership, and effective management.
- ☐ Plan education and career paths aligned to personal goals.
- ☐ Use technology to enhance productivity.
- ☐ Work productively in teams while using cultural global competence.

Unit 3

Inference for Categorical Data: Proportions

Summary and Rationale

This unit introduces sampling distributions and statistical inference. Students learn that sample statistics can be used to estimate corresponding population parameters and that measures of center (mean) and variability (standard deviation) for these sampling distributions can be determined directly from the population parameters when certain sampling criteria are met. For large enough samples from any population, these sampling distributions can be approximated by a normal distribution. Simulating sampling distributions helps students understand how the values of statistics vary in repeated random sampling from populations with known parameters. This unit also introduces statistical inference. Students analyze categorical data to make inferences about binomial population proportions. Provided that conditions are met, students use statistical inference to construct and interpret confidence intervals to estimate population proportions and perform significance tests to evaluate claims about population proportions. Students begin by learning inference

procedures for one proportion and then examine inference methods for a difference between two proportions. They also interpret the two types of errors that can be made in a significance test, the probability of each error occurring, and possible consequences, in context. Students are also introduced to chi-square tests, which can be used when there are two or more categories. Students need to understand how to select between the following two tests: (1) the chi-square test for independence (for associations between categorical variables within a single population), and (2) the chi-square test for homogeneity (for comparing distributions of a categorical variable across populations or treatments). To integrate conceptual understanding, teachers can help students make connections among frequency tables, conditional probability, and calculating expected counts. The chi-square statistic is introduced to measure the distance between observed and expected counts relative to expected counts

Recommended Pacing

7.5 weeks

Standards

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on random samples.
HSS-IC.A.2 Determine whether a probability model is consistent with observed results using simulation.
HSS-IC.B.3 Recognize differences among sample surveys, experiments, and observational studies; explain randomization.
HSS-IC.B.4 Use sample survey data to estimate a population mean or proportion and develop a margin of error.
HSS-IC.B.5 Use randomized experiment data to compare two treatments and determine whether differences between parameters are significant.
HSS-IC.B.6 Evaluate reports based on data.
HSS-ID.B.5 Summarize categorical data using two-way frequency tables and interpret joint, marginal, and conditional relative frequencies.
HSS-CP.A.2 Understand independence of events.
HSS-CP.A.3 Understand conditional probability and its relationship to independence.
HSS-CP.A.4 Construct and interpret two-way frequency tables to determine independence and conditional probabilities.

Interdisciplinary Connections

- Sociology & Market Research: Chi-square tests are used to determine if demographic factors (like gender, age, or socioeconomic status) are independent of consumer preferences or social opinions.
- Public Policy & Law: Proportion-based hypothesis testing evaluates systemic equity or discrimination—such as determining whether jury selection pools or hiring practices match broader demographic populations.

- Political Science: Confidence intervals are critical for interpreting election forecasting, margins of error in political exit polls, and voter approval ratings.

Instructional Focus

Unit Essential Questions:

- How much variation should we expect to see purely by chance when drawing samples?
- How can we use a sample proportion to estimate an unknown population parameter with confidence?
- What constitutes strong evidence that a true population proportion or categorical distribution differs from a baseline claim?

Unit Enduring Understandings:

- EU: DAT (Statistical Inference): Confidence intervals and significance tests use sample statistics to estimate population parameters or test claims about a population, while accounting for sampling variability.
- EU: UNC (Logic of Inference): P-values and confidence levels quantify the strength of evidence against a null hypothesis or the precision of an estimate under repeated sampling conditions.

Evidence of Learning (Assessments)

Assign the Progress Checks from AP Course and Exam Description Resource for each unit.
Each Personal Progress Check contains formative multiple-choice and free-response questions.
The feedback from the Personal Progress Checks shows students the areas where they need to focus.

Objectives (SLO)

3.1 Estimators	3.D Calculate means, standard deviations, and parameters for probability distributions. 4.B Justify a claim based on statistical calculations and results.	2
3.2 Sampling Distributions for Sample Proportions	3.D Calculate means, standard deviations, and parameters for probability distributions. 4.D Interpret statistical calculations and results to assess meaning or a claim. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	1
3.3 Constructing a Confidence Interval for a Population Proportion	2.C Identify appropriate statistical inference methods. 3.E Calculate appropriate statistical inference method results. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
3.4 Justifying a Claim Based on a Confidence Interval for a Population Proportion	2.D Identify types of errors and relationships among components in statistical inference methods. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
3.5 Setting Up a Test for a Population Proportion	2.C Identify appropriate statistical inference methods. 2.E Identify the null and alternative hypotheses. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
3.6 *p*-Values	4.F Interpret results of statistical inference methods.	2
3.7 Carrying Out a Test for a Population Proportion	3.E Calculate appropriate statistical inference method results. 4.G Justify a claim based on statistical inference method results.	2
3.8 Potential Errors When Performing Tests	2.D Identify types of errors and relationships among components in statistical inference methods. 3.C Calculate and estimate expected counts, percentages, probabilities, and intervals.	2

3.9 Sampling Distributions for the Difference Between Sample Proportions	3.D Calculate means, standard deviations, and parameters for probability distributions. 4.D Interpret statistical calculations and results to assess meaning or a claim. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	1
3.10 Constructing a Confidence Interval for the Difference Between Two Population Proportions	2.C Identify appropriate statistical inference methods. 3.E Calculate appropriate statistical inference method results. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
3.11 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Proportions	4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
3.12 Setting Up a Test for the Difference Between Two Population Proportions	2.C Identify appropriate statistical inference methods. 2.E Identify the null and alternative hypotheses. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
3.13 Carrying Out a Test for the Difference Between Two Population Proportions	3.E Calculate appropriate statistical inference method results. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
3.14 Setting Up a Chi-Square Test for Homogeneity or Independence	2.C Identify appropriate statistical inference methods. 2.E Identify the null and alternative hypotheses. 4.C Describe distributions and compare relative positions of points within a distribution. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	3
3.15 Carrying Out a Chi-Square Test for Homogeneity or Independence	3.C Calculate and estimate expected counts, percentages, probabilities, and intervals. 3.E Calculate appropriate statistical inference method results. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	3

Suggested Resources/Technology Tools

College Board AP Website

Modifications

Special Education-
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● Provide small group instruction for identified areas for growth
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Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

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- ☑ Communicate clearly and effectively and with reason.
- ☐ Consider the environmental, social and economics impacts of decisions.
- ☐ Demonstrate creativity and innovation.
- ☑ Employ valid and reliable research strategies.
- ☑ Utilize critical thinking to make sense of problems and persevere in solving them.
- ☐ Model integrity, ethical leadership, and effective management.

- ☐ Plan education and career paths aligned to personal goals.
- ☐ Use technology to enhance productivity.
- ☐ Work productively in teams while using cultural global competence.

Unit 4
Inference for Quantitative Data: Means
Summary and Rationale
In this unit, students analyze quantitative data to make inferences about population means. Students learn that $t*$ and t-tests are used for inference with means when the population standard deviation, σ , is unknown. Using s for σ in the formula for z gives a slightly different value, t. The distribution of t depends on sample size and has more area in the tails than a normal distribution. The boundaries for rejecting a null hypothesis using a t-distribution tend to be further from the mean than for a normal distribution. Students discover how and why conditions for inference with proportions and means are similar and different
Recommended Pacing
6 weeks
Standards
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample. HSS-IC.A.2 Decide if a specified model is consistent with results from a data-generating process. HSS-IC.B.4 Use sample survey data to estimate a population mean or proportion and develop a margin of error. HSS-IC.B.5 Use randomized experiment data to compare two treatments and determine whether differences between parameters are significant. HSS-IC.B.6 Evaluate reports based on data. HSS-ID.A.2 Compare center and spread of data sets using appropriate statistics.

HSS-ID.A.3 Interpret differences in shape, center, and spread in context.

HSS-ID.A.4 Use mean and standard deviation to fit data to a normal distribution and estimate percentages.

Interdisciplinary Connections

- Environmental Science & Ecology: Students use t-tests to evaluate the impact of an environmental factor (e.g., comparing the mean crop yield between fields with different fertilizers, or measuring the change in water acidity before and after a treatment).
- Public Health & Medicine: Paired t-tests are mapped directly to "before-and-after" medical interventions, such as assessing whether a medication successfully reduced patients' mean blood pressure.
- Engineering & Quality Control: Confidence intervals for means allow manufacturers to evaluate whether a machine is consistently meeting structural specifications or weight thresholds.

Instructional Focus

Unit Essential Questions:

- How do the rules of statistical inference change when evaluating continuous measurements (like weight or time) rather than counts?
- How do sample size, confidence level, and standard deviation impact our margin of error?
- How do we determine if an observed difference between sample means is statistically significant or just a random fluke?

Unit Enduring Understandings:

- EU: DAT (Statistical Inference): Confidence intervals and significance tests use sample statistics to estimate population parameters or test claims about a population, while accounting for sampling variability.
- EU: UNC (Logic of Inference): P-values and confidence levels quantify the strength of evidence against a null hypothesis or the precision of an estimate under repeated sampling conditions.

Evidence of Learning (Assessments)

Assign the Progress Checks from AP Course and Exam Description Resource for each unit.
Each Personal Progress Check contains formative multiple-choice and free-response questions.
The feedback from the Personal Progress Checks shows students the areas where they need to focus.

Objectives (SLO)

4.1 Sampling Distributions for Sample Means	3.D Calculate means, standard deviations, and parameters for probability distributions. 4.D Interpret statistical calculations and results to assess meaning or a claim. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	1
4.2 Constructing a Confidence Interval for a Population Mean or Population Mean Difference	2.C Identify appropriate statistical inference methods. 3.E Calculate appropriate statistical inference method results. 4.C Describe distributions and compare relative positions of points within a distribution. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
4.3 Justifying a Claim Based on a Confidence Interval for a Population Mean or Population Mean Difference	2.D Identify types of errors and relationships among components in statistical inference methods. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
4.4 Setting Up a Test for a Population Mean or Population Mean Difference	2.C Identify appropriate statistical inference methods. 2.E Identify the null and alternative hypotheses. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
4.5 Carrying Out a Test for a Population Mean or Population Mean Difference	3.E Calculate appropriate statistical inference method results. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
4.6 Sampling Distributions for the Difference Between Two Sample Means	3.D Calculate means, standard deviations, and parameters for probability distributions. 4.D Interpret statistical calculations and results to assess meaning or a claim. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	1

4.7 Constructing a Confidence Interval for the Difference Between Two Population Means	2.C Identify appropriate statistical inference methods. 3.E Calculate appropriate statistical inference method results. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
4.8 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Means	4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2
4.9 Setting Up a Test for the Difference Between Two Population Means	2.C Identify appropriate statistical inference methods. 2.E Identify the null and alternative hypotheses. 4.E Justify the use of a chosen statistical inference method by verifying conditions.	2
4.10 Carrying Out a Test for the Difference Between Two Population Means	3.E Calculate appropriate statistical inference method results. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results.	2

Suggested Resources/Technology Tools

College Board AP Website

Modifications

Special Education-

Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.

- Allow additional time for skill mastery.
- Provide small group/ individualized instruction.
- Allow use of assistive technology.
- Anticipate needs; pre-teach if needed.
- Have student repeat directions to check for understanding.
- Highlight text/ visual presentation.
- Modify assessment/assignment content, format, length (benchmarks, tests and quizzes) .

ML-

- Provide additional wait time for student responses to questions
- Provide simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase.

● Speak clearly, using a normal tone and rate of speed, or slightly slower.
● Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading

Gifted and Talented-

● Advance, accelerate, or compact content
● Support abstract and advanced higher-level thinking through differentiated questioning
● Allowance for adapting of content for individual student interests
● Provide assignments geared to development in areas of affect, creativity, cognition, and research skills

504-

Modifications and accommodations must be aligned to the 504 plan and uphold expectations of the plan lawfully.

● Provide additional time for in-class assignments and assessments
● Allow for computer with voice output, spelling and grammar checker
● Offer individual help throughout the lesson
● Modify readings and primary source documents

At Risk-

● Provide small group instruction for identified areas for growth
● Allow for alternate pathways for completion of assignments.
● Provide additional wait time for student responses to questions
● Pair oral instruction with visuals
● Utilize manipulatives

For a full list of Accommodations and Modifications, please click here.

Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

Please select all standards that apply to this unit of study:

- ☐ Act as a responsible and contributing citizen and employee.
- ☑ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☑ Communicate clearly and effectively and with reason.
- ☐ Consider the environmental, social and economics impacts of decisions.
- ☐ Demonstrate creativity and innovation.
- ☑ Employ valid and reliable research strategies.
- ☑ Utilize critical thinking to make sense of problems and persevere in solving them.
- ☐ Model integrity, ethical leadership, and effective management.
- ☐ Plan education and career paths aligned to personal goals.
- ☐ Use technology to enhance productivity.
- ☐ Work productively in teams while using cultural global competence.

Unit 5
Regression Analysis
Summary and Rationale
In this unit, students explore relationships in two-variable quantitative data sets. Students describe form, direction, strength, and unusual features for an association between two quantitative variables. They assess correlation and, if appropriate, use a linear model to predict values of the response variable from values of the explanatory variable. Students interpret the least-squares regression line in context, analyze prediction errors (i.e., residuals), and explore departures from a linear pattern.
Recommended Pacing
2 weeks
Standards
HSS-ID.B.6 Represent two quantitative variables on a scatterplot and describe their relationship. HSS-ID.B.6.a Fit functions to data and use models to solve problems. HSS-ID.B.6.b Assess the fit of a function by plotting and analyzing residuals. HSS-ID.B.6.c Fit a linear function to data that suggests a linear association. HSS-ID.C.7 Interpret the slope and intercept of a linear model in context. HSS-ID.C.8 Compute and interpret the correlation coefficient using technology. HSS-ID.C.9 Distinguish between correlation and causation.
Interdisciplinary Connections
● Economics & Business: Regression slopes are heavily relied upon to establish trends between variables, such as how changes in advertising spending affect revenue, or analyzing macroeconomic correlations like GDP vs. inflation. ● Physical & Life Sciences: Linear models evaluate physical laws and biological growths, such as mapping the correlation between temperature changes and enzyme activity, or carbon dating variables. ● Computer Science & Tech: The concept of minimizing residuals via a least-squares regression line introduces students to the algorithmic foundations of predictive modeling and machine learning.
Instructional Focus
Unit Essential Questions: ● How can we mathematically model and evaluate the relationship between two numerical variables?

- What information do the slope, correlation coefficient (r), and coefficient of determination (r^2) provide about a trend?
- How do we evaluate if a linear model is appropriate, and how do we check for influential outliers?

Unit Enduring Understandings:
EU: DAT (Linear and Non-linear Relationships): Models describe relationships between variables, and evaluating residuals or slope significance helps determine the appropriateness of a linear model.

Evidence of Learning (Assessments)

Assign the Progress Checks from AP Course and Exam Description Resource for each unit.
Each Personal Progress Check contains formative multiple-choice and free-response questions.
The feedback from the Personal Progress Checks shows students the areas where they need to focus.

Objectives (SLO)

5.1 Graphical Representations Between Two Quantitative Variables	3.A Construct tabular and graphical representations of data and distributions. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.B Justify a claim based on statistical calculations and results.	1
5.2 Correlation	4.D Interpret statistical calculations and results to assess meaning or a claim.	2
5.3 Linear Regression Models	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses.	2
5.4 Residuals	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.A Describe and compare tabular and graphical representations of data, as well as summary statistics. 4.D Interpret statistical calculations and results to assess meaning or a claim.	2
5.5 Least-Squares Regression	3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 4.D Interpret statistical calculations and results to assess meaning or a claim.	2

Suggested Resources/Technology Tools

College Board AP Website

Modifications

Special Education-
Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.
● Allow additional time for skill mastery.
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