TAMALPAIS UNION HIGH SCHOOL DISTRICT

AP Statistics

Overview Information

Title of Course: **AP Statistics**	
Course Author(s): Natasha Roberts Jason Adams Wendy Baumgartner	**Schools where the course will be taught:** Archie Williams Tamalpais High School Redwood High School
Length of Course: 1 year	**Subject Area and Discipline**: Mathematics, Statistics
Grade Levels: 10-12	**Is this course an integrated course?** no
Is this course being submitted for possible UC honors designation? no	**Are you seeking UC approval? If so, in what area (A-G)?** Area C Math
Prerequisites (required or recommended): B in Advanced Algebra or C in Precalculus	**Co-requisites** (required or recommended): none
If there are prerequisites for the course, please include a justification as to why they are in place: AP Statistics is a rigorous college level course that utilizes many of the skills and habits students develop in previous math courses.	
Check all that apply: ✅UC A-G course ❑ Graduation Requirement (specify the requirement this course meets) ✅Elective ✅Honors/AP ❑ CTE	

Introduction to the Course

Course Overview:
AP Statistics is a college-level course that introduces students to the major concepts and tools used to collect, analyze, and draw conclusions from data. Aligned with the American Statistical Association's GAISE II framework, the course emphasizes the statistical problem-solving process and the development of critical statistical reasoning skills. Students learn to interpret data, design studies, use probability and inference, and communicate statistical findings effectively. The course prepares students for advanced study in statistics and related fields while fostering informed decision-making in a data-driven world.

Unit 1: Exploring One-Variable Data and Collecting Data

Unit Summary: In Unit 1, students learn how to design and analyze statistical studies by identifying key components, asking investigative questions, and working with categorical and quantitative data. They develop skills in representing, describing, and comparing data distributions while interpreting statistical results to evaluate claims about individuals and samples. Students also learn to communicate about data in meaningful real-world contexts and recognize that not all observed variation in data is significant. A major focus is understanding how sampling methods and experimental design affect the validity of conclusions, including the role of bias and the ability to generalize findings to larger populations. Finally, students learn that well-designed experiments can provide evidence of cause-and-effect relationships when statistically significant differences are observed among treatment groups.

Essential Questions:

- What kind of question can be answered using data from websites?
- What kind of data is collected about me on social media?
- What methods should I use to collect the data to conduct future inference procedures?

Sample Unit Assignments:

- Gallery Walk : Have students work in groups of four to construct a dotplot, stem-and-leaf plot, histogram, or boxplot for a set of student-generated data (e.g., time in minutes to get to school). After the gallery walk, discuss what information can be seen more easily in each graph (e.g., boxplots can easily show the IQR).
- Password-Style Games : After completing the lessons on sampling and surveying, use the following nine terms in a password-style game: simple random sample, stratified random sample, cluster random sample, systematic random sample, bias, voluntary response bias, undercoverage bias, nonresponse bias, and response bias. Pair students and ask one student per pair to sit facing the back of the classroom. Project or write the terms on the board one at a time while the front-facing students give clues to their partners, who try to guess the terms. The winner is the pair that guesses the most terms

Sample Unit Assessment:

Students in AP Statistics are expected to demonstrate a thorough understanding of statistical concepts through both multiple-choice and free-response questions. In Unit 1 , students are required to complete, context-based explanations, careful interpretation of data, and give attention to all aspects of a question. Students need precise statistical communication skills, including the correct use of terms such as random selection and random assignment, and learn to justify conclusions using appropriate statistical reasoning. Emphasis is placed on connecting statistical results to real-world contexts and clearly explaining the evidence that supports conclusions.

All assessments should match the level of rigor and format of assessment items on the AP Exam. Use sample assessment items from textbooks, the College Board Course and Exam Description, and AP Classroom - Topic Questions and Personal Progress Checks from Unit 1.

Unit 1 Topics and Skill Outcomes	
Unit Topics 1.1 Introducing Statistics: What Can We Learn from Data? 1.2 Variables 1.3 Tabular Representation and Summary Statistics for One Categorical Variable 1.4 Graphical Representations for One Categorical Variable 1.5 Graphical Representations for One Quantitative Variable 1.6 Descriptions for One Quantitative Variable Distributions 1.7 Summary Statistics for One Quantitative Variable 1.8 Graphical Representations of Summary Statistics for One Quantitative Variable 1.9 Comparisons of the Distributions for One Quantitative Variable 1.10 The Investigative Question Revisited and Data Collection 1.11 Random Sampling 1.12 Potential Problems with Sampling 1.13 Experimental Design	**Skill Outcomes: Throughout this unit of study, students will engage in the following:** 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. 3.A Construct tabular and graphical representations of data and distributions. 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.

Unit 2: Probability, Random Variables, and Probability Distributions
Unit Summary: In Unit 2, students investigate relationships in two-variable categorical data and use these relationships to develop an understanding of probability concepts and rules. They learn how probabilistic reasoning helps statisticians quantify the likelihood of random events and make inferences about real-world situations. Through simulations, concrete examples, and theoretical models, students explore probability distributions for discrete random variables and learn to calculate and interpret their parameters. Emphasis is placed on interpreting probabilities within context, using appropriate units, and connecting mathematical results to meaningful situations. The unit also introduces the standard normal distribution, the empirical rule, sampling distributions, and the Central Limit Theorem as foundational tools for statistical inference. **Essential Questions** ● How might we represent the reading habits of people with and without an electronic reading device to help describe similarities and/or differences between two groups? ● How can the weather be predicted? ● Why might the data we collect influence decisions being made?
Sample Unit Assignments: ● Quiz-Quiz-Trade : Give students a card containing a question with a two-way table and have them write the answer on the back. Then have them stand up and find a partner. One student quizzes the other, and then they reverse roles. Have them switch cards, find a new partner, and repeat the process.

- Think-Pair-Share : Provide students with a set of five probability questions: one for each of the complement rules, a mutually exclusive event, a conditional probability, the general multiplication rule, and an independent event. Ask students to individually identify the formula needed to solve each problem without doing the final calculations. Then have them share their thoughts with a partner.

Sample Unit Assessment:
Assessment in Unit 2 focuses on students' ability to apply probability concepts through multiple-choice questions, question sets, and free-response tasks. Students are expected to clearly show all steps in probability and distribution calculations, including the correct formula, substitution of values, and final answer. They must accurately identify distributions, label relevant parameters, and indicate appropriate boundaries and directions when calculating probabilities. Emphasis is placed on communicating statistical reasoning clearly and using proper notation to support solutions.

All assessments should match the level of rigor and format of assessment items on the AP Exam.
Use sample assessment items from textbooks, the College Board Course and Exam Description, and AP Classroom - Topic Questions and Personal Progress Checks from Unit 2.

Unit 2 Topics and Skill Outcomes

Unit Topics	**Skill Outcomes: Throughout this unit of study, students will engage in the following:**
2.1 Tabular and Graphical Representations for the Distributions of Two Categorical Variables 2.2 Summary Statistics for Two Categorical Variables 2.3 Estimating Probabilities Using Simulation 2.4 Introduction to Probability 2.5 Mutually Exclusive Events 2.6 Conditional Probability 2.7 Independent Events and Unions of Events 2.8 Introduction to Random Variables and Probability 2.9 Parameters of Random Variables 2.10 The Binomial Distribution 2.11 The Normal Distribution 2.12 Sampling Distributions and the Central Limit Theorem	3.A Construct tabular and graphical representations of data and distributions. 3.B Calculate summary statistics, relative positions of points within a distribution, and predicted responses. 3.C Calculate and estimate expected counts, percentages, probabilities, and intervals. 3.D Calculate means, standard deviations, and parameters for probability 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. 4.C Describe distributions and compare relative positions of points within a distribution. 4.D Interpret statistical calculations and results to assess meaning or a claim.

Unit 3: Inference for Categorical Data: Proportions

Unit Summary: In Unit 3, students learn how sample statistics can be used to estimate population parameters through the study of sampling distributions and statistical inference. They examine how the mean and standard deviation of sampling distributions relate to population parameters and learn that, for sufficiently large samples, these distributions can often be approximated by a normal distribution. Through simulations, students develop an understanding of how sample statistics vary across repeated random samples from the same population. The unit introduces confidence intervals and significance tests for population proportions, including procedures for both a single proportion and the difference between two proportions, as well as the interpretation of Type I and Type II errors in context. Students also learn to analyze categorical data using chi-square tests and determine when to use tests for independence versus tests for homogeneity. Throughout the unit, they connect concepts such as frequency tables, conditional probability, expected counts, and the chi-square statistic to draw

meaningful conclusions from categorical data.

Essential Questions:

- How can we measure changing opinions in populations over time?
- When can we perform inference calculations using data from websites to answer everyday questions?
- How can we determine whether the difference between two groups is statistically significant?
- Are the distributions of various types of wild birds different in urban areas than in rural areas?

Sample Unit Assignments:

- Error Analysis : Give student pairs a worksheet with 20 sets of hypotheses, each with a common student mistake. Be sure to include hypotheses for a test for a population proportion, a test for the difference between two proportions, a chi-square test for independence, and a chi-square test for homogeneity. Have students circle the incorrect part, write why the circled component is incorrect, and then write the correct hypotheses. Include errors such as using statistics instead of parameters and interchanging the = and > in the two hypotheses.
- Sentence Starters : For a given question, provide students with a set of hypotheses, p-value, significance level, and context. Have them compare the p-value to the significance level to determine whether to reject the null hypothesis. Use a sentence starter with blanks to fill in, and have students write a sentence in context explaining whether they have enough evidence to reject H_0 or if they will fail to reject H_0. Make sure students avoid the common mistake of implying that evidence supports an accept H_0 conclusion or a reject H_0 conclusion.

Sample Unit Assessment:

Assessment in Unit 3 evaluates students through multiple-choice and free-response questions that focus on sampling distributions and statistical inference. Students must clearly distinguish between population distributions, sample data, and sampling distributions, using precise statistical language to avoid ambiguity. When conducting confidence intervals and hypothesis tests for proportions, students are expected to identify the correct inference procedure, verify all required conditions, and accurately interpret results in context. Students must also demonstrate proficiency with chi-square tests by stating hypotheses in context, checking conditions, and calculating and interpreting results appropriately. Emphasis is placed on clear communication of statistical reasoning, proper use of p-values, and drawing conclusions that are supported by the evidence. Successful responses include complete calculations, verification of assumptions, and conclusions that accurately reflect the statistical findings without overstating results.

All assessments should match the level of rigor and format of assessment items on the AP Exam.
Use sample assessment items from textbooks, the College Board Course and Exam Description, and AP Classroom - Topic Questions and Personal Progress Checks from Unit 3.

Unit 3 Topics and Skill Outcomes

Unit Topics	**Skill Outcomes: Throughout this unit of study, students will engage in the following:**
3.1 Estimators 3.2 Sampling Distributions for Sample Proportions 3.3 Constructing a Confidence Interval for a Population Proportion 3.4 Justifying a Claim Based on a Confidence Interval for a Population Proportion 3.5 Setting Up a Test for a Population Proportion 3.6 p-Values 3.7 Carrying Out a Test for a Population Proportion 3.8 Potential Errors When Performing Tests 3.9 Sampling Distributions for the Difference	2.C Identify appropriate statistical inference methods. 2.D Identify types of errors and relationships among components in statistical inference methods. 2.E Identify the null and alternative hypotheses. 3.C Calculate and estimate expected counts, percentages, probabilities, and intervals. 3.D Calculate means, standard deviations, and parameters for probability distributions.

Between Sample Proportions 3.10 Constructing a Confidence Interval for the Difference Between Two Population Proportions 3.11 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Proportions 3.12 Setting Up a Test for the Difference Between Two Population Proportions 3.13 Carrying Out a Test for the Difference Between Two Population Proportions 3.14 Setting Up a Chi-Square Test for Homogeneity or Independence 3.15 Carrying Out a Chi-Square Test for Homogeneity or Independence	3.E Calculate appropriate statistical inference method results. 4.B Justify a claim based on statistical calculations and results. 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. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results

Unit 4: Inference for Quantitative Data: Means

Unit Summary: In Unit 4, 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.

Essential Questions:

- How can we compare the average salaries of different professions across different regions of a country?
- How can we evaluate the effectiveness of a new medicine in lowering cholesterol for older adults?
- How can a pre-test and a post-test be used to evaluate student learning?

Sample Unit Assignments:

- Team Challenge: Marking the Text : Give students examples of statistical situations. Have them highlight or underline the key phrases to help them determine which statistical test to use for each situation. For example, does it require a significance test or a confidence interval? Does it involve means or proportions? Is there only one variable, or are there two or more variables?
- Round Table : Arrange students in groups of four and give each student an identical paper containing four different inference procedure problems from Unit 4. Have students complete the first one on their paper and then pass the paper clockwise to another member in their group. That student checks the first problem and then completes the second problem on the paper. Have students rotate again, continuing the process until each student has their original paper back.

Sample Unit Assessment:

Assessment in Unit 4 includes multiple-choice and free-response questions that emphasize statistical inference and hypothesis testing. Students are expected to recognize when a question requires a significance test rather than a descriptive analysis and to correctly identify parameters, hypotheses, and appropriate test procedures. They must verify conditions, calculate test statistics and p-values, and draw conclusions in context using evidence from the significance level. Success in this unit requires clear communication of statistical reasoning and the ability to distinguish among the inference procedures learned in Units 3 and 4.

All assessments should match the level of rigor and format of assessment items on the AP Exam.
Use sample assessment items from textbooks, the College Board Course and Exam Description, and AP Classroom - Topic Questions and Personal Progress Checks from Unit 4.

Unit 4 Topics and Skill Outcomes	
Unit Topics 4.1 Sampling Distributions for Sample Means 4.2 Constructing a Confidence Interval for a Population Mean or Population Mean Difference 4.3 Justifying a Claim Based on a Confidence Interval for a Population Mean or Population Mean Difference 4.4 Setting Up a Test for a Population Mean or Population Mean Difference 4.5 Carrying Out a Test for a Population Mean or Population Mean Difference 4.6 Sampling Distributions for the Difference Between Two Sample Means 4.7 Constructing a Confidence Interval for the Difference Between Two Population Means 4.8 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Means 4.9 Setting Up a Test for the Difference Between Two Population Means 4.10 Carrying Out a Test for the Difference Between Two Population Means	**Skill Outcomes: Throughout this unit of study, students will engage in the following:** 2.C Identify appropriate statistical inference methods. 2.D Identify types of errors and relationships among components in statistical inference methods. 2.E Identify the null and alternative hypotheses. 3.D Calculate means, standard deviations, and parameters for probability distributions. 3.E Calculate appropriate statistical inference method results. 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. 4.F Interpret results of statistical inference methods. 4.G Justify a claim based on statistical inference method results

Unit 5: Regression Analysis

Unit Summary: In Unit 5, 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.

Essential Questions:

- Does the fact that the number of shark attacks increases as ice cream sales increase necessarily mean that ice cream sales cause shark attacks?
- How can we determine the effectiveness of a linear model that uses the number of cricket chirps per minute to predict temperature?

Sample Unit Assignments:

- Reversing Interpretations : Instead of asking students to interpret a residual, give them the residual and the equation of the least-squares regression line and ask them to make a prediction for a particular observation (e.g., “One wolf in the pack had a length of 14. m and a residual of −98. 7. What does that −98. 7 tell us about that particular wolf?”)
- Team Challenge : Set up teams of three or four and task students with solving different multiple-part problems in Unit 5 with different datasets to answer investigative questions. Have teams explain their work to other teams.

Sample Unit Assessment:

Assessment in Unit 5 includes multiple-choice questions and portions of a free-response question focused

on interpreting relationships in data. Students are expected to accurately interpret vocabulary and numerical results in context, especially when describing linear relationships and regression models. Responses must use precise statistical language, distinguishing between general change and rate of change, and correctly describing what a positive or negative relationship means in real-world terms. Students should also communicate uncertainty appropriately using language such as "tends to" or "on average," while clearly and correctly using terms like correlation when discussing relationships between quantitative variables.

All assessments should match the level of rigor and format of assessment items on the AP Exam.
Use sample assessment items from textbooks, the College Board Course and Exam Description, and AP Classroom - Topic Questions and Personal Progress Checks from Unit 5.

Unit 5 Topics and Skill Outcomes	
Unit Topics 5.1 Graphical Representations Between Two Quantitative Variables 5.2 Correlation 5.3 Linear Regression Models 5.4 Residuals 5.5 Least-Squares Regression	**Skill Outcomes: Throughout this unit of study, students will engage in the following:** 3.A Construct tabular and graphical representations of data and distributions. 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.D Interpret statistical calculations and results to assess meaning or a claim.

Recommended Texts and Resources:

- AP Classroom
- Math Medic
- Desmos
- TI84 graphing calculator

The following Textbook will be piloted in the Fall of 2026: **The Practice of Statistics, 8th Edition Daren Starnes & Josh Tabor**ISBN 978-1-319-61328-0 (Student Edition)

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