MT. DIABLO UNIFIED SCHOOL DISTRICT
COURSE OF STUDY
DRAFT

COURSE TITLE:	**Statistics (AP)**
COURSE NUMBER:	**1530**
CALPADS NUMBER:	**2483**
CST:	**Summative Math**
DEPARTMENT:	**Mathematics**
NCLB TEACHER CREDENTIAL REQUIREMENT:	**Math Credential with Subject Matter Proficiency**
LENGTH OF COURSE:	**One year**
CREDITS PER SEMESTER:	**5**
GRADE LEVEL(S)	**11-12**
REQUIRED OR ELECTIVE:	**This course fulfills one year of the high school mathematics requirement, and UC/CSU "c" requirement.**
PREREQUISITES:	**C or better in Algebra II**

BOARD OF EDUCATION ADOPTION:

COURSE DESCRIPTION:

The purpose of the AP course in 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. Students who successfully complete the course and exam may receive credit, advanced placement, or both for a one-semester introductory college statistics course. This discipline is a technical and in-depth extension of probability and statistics. In particular, mastery of academic content for advanced placement gives students the background to succeed in the Advanced Placement examination in the subject.

COURSE OUTLINE:

1. **MAJOR GOALS**

   1.1 Exploring Data: Describing patterns and departures from patterns
   1.2 Sampling and Experimentation: Planning and conducting a study
   1.3 Anticipating Patterns: Exploring random phenomena using probability and simulation
   1.4 Statistical Inference: Estimating population parameters and testing hypotheses

2. **PERFORMANCE OBJECTIVES:**

   2.1 Solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events.

   2.2 Know the definition of conditional probability and use it to solve for probabilities in finite sample spaces.

   2.3 Demonstrate an understanding of the notion of discrete random variables by using this concept to solve for the probabilities of outcomes, such as the probability of the occurrence of five or fewer heads in 14 coin tosses.

2.4 Understand the notion of a continuous random variable and can interpret the probability of an outcome as the area of a region under the graph of the probability density function associated with the random variable.

2.5 Know the definition of the mean of a discrete random variable and can determine the mean for a particular discrete random variable.

2.6 Know the definition of the variance of a discrete random variable and can determine the variance for a particular discrete random variable.

2.7 Demonstrate an understanding of the standard distributions (normal, binomial, and exponential) and can use the distributions to solve for events in problems in which the distribution belongs to those families.

2.8 Determine the mean and the standard deviation of a normally distributed random variable.

2.9 Know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially.

2.10 Know the definitions of the mean, median, and mode of distribution of data and can compute each of them in particular situations.

2.11 Compute the variance and the standard deviation of a distribution of data.

2.12 Find the line of best fit to a given distribution of data by using least squares regression.

2.13 Know what the correlation coefficient of two variables means and are familiar with the coefficient's properties.

2.14 Organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line graphs and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.

2.15 Understand the notions of a statistic of a distribution of values, of the sampling distribution of a statistic, and of the variability of a statistic.

2.16 Know basic facts concerning the relation between the mean and the standard deviation of a sampling distribution and the mean and the standard deviation of the population distribution.

2.17 Determine confidence intervals for a simple random sample from a normal distribution of data and determine the sample size required for a desired margin of error.

2.18 Determine the P- value for a statistic for a simple random sample from a normal distribution.

2.19 Know the chi- square distribution and chi- square test and understand their uses.

3. CONTENT OUTLINE:

3.1 Exploring Data: Describing patterns and departures from patterns

3.1.1 Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)
- 3.1.1.1 Center and spread
- 3.1.1.2 Clusters and gaps
- 3.1.1.3 Outliers and other unusual features
- 3.1.1.4 Shape

3.1.2 Summarizing distributions of univariate data
- 3.1.2.1 Center: median, mean
- 3.1.2.2 Spread: range, interquartile range, standard deviation
- 3.1.2.3 Position: quartiles, percentiles, standardized scores (z-scores)
- 3.1.2.4 Boxplots
- 3.1.2.5 The effect of changing units on summary measures

3.1.3 Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
- 3.1.3.1 Comparing center and spread: within group, between group variation
- 3.1.3.2 Comparing clusters and gaps
- 3.1.3.3 Comparing outliers and other unusual features
- 3.1.3.4 Comparing shapes

3.1.4 Exploring bivariate data
- 3.1.4.1 Analyzing patterns in scatterplots
- 3.1.4.2 Correlation and linearity
- 3.1.4.3 Least-squares regression line
- 3.1.4.4 Residual plots, outliers, and influential points
- 3.1.4.5 Transformations to achieve linearity: logarithmic and power transformations

3.1.5 Exploring categorical data
- 3.1.5.1 Frequency tables and bar charts
- 3.1.5.2 Marginal and joint frequencies for two-way tables
- 3.1.5.3 Conditional relative frequencies and association
- 3.1.5.4 Comparing distributions using bar charts

3.2 Sampling and Experimentation: Planning and conducting a study

3.2.1 Overview of methods of data collection
- 3.2.1.1 Census
- 3.2.1.2 Sample survey
- 3.2.1.3 Experiment
- 3.2.1.4 Observational study

3.2.2 Planning and conducting surveys

3.2.3 Characteristics of a well-designed and well-conducted survey
- 3.2.3.1 Populations, samples, and random selection
- 3.2.3.2 Sources of bias in sampling and surveys
  - 3.2.3.2.1 Sampling methods, including simple random sampling, stratified random sampling and cluster sampling

3.3 Anticipating Patterns: Exploring random phenomena using probability and simulation

3.3.1 Probability
- 3.3.1.1 "Law of Large Numbers" concept
- 3.3.1.2 Addition rule, multiplication rule, conditional probability, and independence
- 3.3.1.3 Discrete random variables and their probability distributions, including binomial and geometric
- 3.3.1.4 Simulation of random behavior and probability distributions
- 3.3.1.5 Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable

3.3.2 Combining independent random variables
- 3.3.2.1 Notion of independence versus dependence
- 3.3.2.2 Mean and standard deviation for sums and differences of independent random variables

3.3.3 The normal distribution
- 3.3.3.1 Properties of the normal distribution
- 3.3.3.2 Using tables of the normal distribution
- 3.3.3.3 The normal distribution as a model for measurements

3.3.4 Sampling distributions
- 3.3.4.1 Sampling distribution of a sample proportion
- 3.3.4.2 Sampling distribution of a sample mean
- 3.3.4.3 Central Limit Theorem
- 3.3.4.4 Sampling distribution of a difference between two independent sample proportions
- 3.3.4.5 Sampling distribution of a difference between two independent sample means
- 3.3.4.6 Simulation of sampling distributions
- 3.3.4.7 t-distribution
- 3.3.4.8 Chi-square distribution

3.4 Statistical Inference: Estimating population parameters and testing

3.4.1 Estimation (point estimators and confidence intervals)
- 3.4.1.1 Estimating population parameters and margins of error
- 3.4.1.2 Properties of point estimators, including unbiasedness and variability
- 3.4.1.3 Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
- 3.4.1.4 Large sample confidence interval for a proportion
- 3.4.1.5 Large sample confidence interval for a difference between two proportions
- 3.4.1.6 Confidence interval for a mean
- 3.4.1.7 Confidence interval for a difference between two means (unpaired and paired)
- 3.4.1.8 Confidence interval for the slope of a least-squares regression line

3.4.2 Tests of significance
- 3.4.2.1 Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided test; concepts of Type I and Type II errors; concept of power
- 3.4.2.2 Large sample test for a proportion
- 3.4.2.3 Large sample test for a difference between two proportions
- 3.4.2.4 Test for a mean

3.4.2.5 Test for a difference between two means (unpaired and paired)
3.4.2.6 Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)
3.4.2.7 Test for the slope of a least-squares regression line

4. **TIME ESTIMATES:** Instructional sequences vary in length from a few days to several weeks (all material must be completed by the scheduled AP Testing Date)

5. **INSTRUCTIONAL MATERIALS:**
   5.1 District adopted textbook
   5.2 Supplementary and teacher created materials
   5.3 Technology Materials (Currently, the graphing calculator is the only computational aid that is available to students for use as a tool for data analysis on the AP Exam)

6. **EVALUATION OF STUDENT PROGRESS:** Student communicates mathematically and demonstrates content knowledge in a variety of ways that lead to mathematical competence.
   6.1 Pre and post tests and quizzes
   6.2 Teacher observation
   6.3 Written Assignments
   6.4 Rubrics
   6.5 Special Projects
   6.6 Previous AP Free Responses

Committee Members:

Danielle Dell	CVHS
Frank Bruketta	CVHS
Susan Seeley	CVHS
Bodhi Young	CVHS
Suzette Blanke	CPHS
Robert Lovelace	CPHS
Angel Niedzielski	CPHS
Norma Meyerkorth	CHS
Brianne Whiteside	CHS
Kathleen Magana	MDHS
Steve Sankey	MDHS
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