

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

**Course Outline
Problem Solving, Statistics & Probability**

Date: May 2003

Subject Area: Mathematics

Proposed Grade Level(s): 11-12

Course Length: 1 Year

Grading: A-F

Number of Credits: 5/Semester

Prerequisites: Completion of Algebra 2

BRIEF COURSE DESCRIPTION:

This course is taught as two distinct semester courses. The Problem Solving semester focuses on 17 strategies for solving problems, one new strategy each week. Each week a new technique is presented to the class that they will then practice in class in groups and at home alone. Students are expected to prepare and present solutions to the class on a regular basis.

The Statistics and Probability portion of the class is a college prep course in elementary statistics and probability designed for seniors who have passed Algebra 2 or juniors who have passed pre-calculus and do not wish to enroll in Calculus. Topics include data collection, organizing, analyzing and interpreting data, measures of central tendency, variation, distribution, confidence intervals, correlation, regression, chi square, hypothesis testing, sample spaces, probability, sets, combinations, and permutations.

GENERAL GOALS/PURPOSES:

- To provide a math course that will improve and maintain math skills to students who do not wish to or are unable to take calculus
- To develop formal problem-solving abilities which give students confidence in solving all manner of problems using a variety of techniques
- To develop in students an ability to communicate mathematical reasoning and mathematical ideas
- To present skills and processes fundamental to the further study of statistics and probability

STUDENT READING COMPONENT:

In both semesters, material is taught where analytical reading is fundamental to the successful execution of the problems. During the problem-solving semester, students will learn problem-solving techniques that can be used to analyze and develop a plan of attack to solve the problems presented. Statistics also presents problems in a fashion that emphasizes analytical reading skills.

STUDENT WRITING/ORAL COMPONENT:

Both semesters emphasize material in which the presentation and interpretation of results is key to the successful completion of any problem. Students will be expected to present their work to the class and for the teacher in both written and oral presentations. The development of these skills is a critical part of a student's ability to create a persuasive logical argument in any setting and in any subject. All written work will follow

standard rules of English. Any research projects will follow MLA format, which has been distributed at all secondary sites.

Final Assessment:

Comprehensive fall and spring semester finals.

DETAILED UNITS OF INSTRUCTION:

Fall Semester: Problem Solving

Text: Problem Solving Strategies; Crossing the River with Dogs and other Mathematical Adventures, Johnson and Herr; Key Curriculum Press

- Week 1: Introduction to Problem Solving: Students introduced to sample problems and learn how to work collaboratively in groups of four.
- Week 2: Draw a Diagram: Students use diagrams and pictures to aid them in solving problems.
- Week 3: Systematic Lists: Students learn to solve problems by writing a systematic list and then convince the reader the list is comprehensive and does in fact solve the problem.
- Week 4: Eliminate possibilities: Students solve problems by taking the systematic list of possibilities and eliminating those that are not possible.
- Week 5: Matrix Logic: Students apply previous week's techniques with matrix grids to solve problems.
- Week 6: Look for a pattern: Students work with one of the oldest and most powerful of mathematical problem solving techniques. Students will work with sequences, series, function tables, Fibonacci sequences, spreadsheets, and Pascal's triangle.
- Week 7: Guess and check: Students will refine and modify their "guessing" as they perfect this familiar technique.
- Week 8: Sub problems: Students will learn to plan and document a plan of attack to take a complex problem and make it into a series of simpler problems.
- Week 9: Unit Analysis: Students solve problems by organizing the information from the problem and then tracking and using units or applying appropriate ratios of units.
- Week 10: Solve an easier related problem: Students will find other ways to approach problem that seem impossible or impossibly tedious by solving an easier related problem then looking for a pattern or way to apply this solution to the original problem.
- Week 11: Physical representation: Students use models or manipulatives to organize, attack and solve problems. The goal is to make problem concrete and therefore more easily understood.
- Week 12: Work backwards: Students will present solutions by first writing the problem down in forward progression, writing the reverse, and then following the work backwards technique to render the solution.
- Week 13: Venn Diagrams: Students create, organize, and analyze 2 and 3 set Venn diagrams.
- Week 14: Algebra: Students connect their work to previous algebra courses. Students will define, write, solve and check both 1 variable and simultaneous equations.
- Week 15: Finite Differences: Students solve problems by organizing and analyzing function table data and using finite differences to induce the related function.
- Week 16: Organize information: In addition to the techniques already covered by the course students will work with tables, charts, tree diagrams, and spreadsheets.
- Week 17: Change focus: Change your point of view, solve the complementary problem and change the representation – sometimes this works better than the direct approach. Statistics provides many examples where figuring out how often something does not happen is easier to calculate than how often it does.
- Week 18: Spatial organization: Students solve problems by making and analyzing graphs and scale drawings. Graphs include line graphs, scatter plots, and quadratic graphs.

Spring Semester: Probability and Statistics

1. Nature of probability and statistics (1 week)
 - a. Descriptive and inferential statistics
 - b. Types of data
 - c. Data collection and sampling techniques
 - Systematic, Stratified, and cluster sampling
2. Frequency distributions and graphs (1 week)
 - a. Organizing data
 - b. Frequency distributions
 - Categorical, ungrouped, and grouped
 - c. Histograms
 - d. Frequency polygons
 - e. Ogives
 - f. Times series chart
 - g. Pareto charts
 - h. Pie charts
 - i. Misleading graphs
3. Data description (2 weeks)
 - a. Measures of central tendency
 - Mean, Median, Mode
 - Midrange
 - Geometric, Quadratic, and Harmonic means
 - b. Measures of variation
 - Range
 - c. Variance
 - d. Standard deviation
 - e. Chebyshev's Theorem
 - f. Measure of position
 - Percentiles, quartiles
 - Outliers
 - g. Stem and Leaf plots
 - h. Box and Whisker plots
 - Minimum, median and maximum\
 - Lower and upper hinges
4. Counting techniques (2 weeks)
 - a. Tree diagrams
 - b. Counting
 - c. Permutations
 - d. Combinations
5. Probability (2 weeks)
 - a. Sample spaces
 - b. Probability
 - Mutually exclusive events
 - Dependent and independent events
 - Conditional probability
 - c. Bayes' Theorem
6. Probability distributions (2 weeks)
 - a. Probability distribution for a random variable
 - b. Mean of a random variable
 - c. Variance for a probability distribution
 - d. Expected value of a variable for a probability distribution

- e. Binomial distribution
- f. Poisson Distribution
- 7. Confidence intervals (2 weeks)
 - a. Confidence intervals for the mean
 - b. Sample Size
 - c. Chi Square distribution
 - d. Confidence interval for a variance or standard deviation
- 8. Hypothesis testing (2 weeks)
 - a. Null hypothesis
 - b. Right, Left, and Two-tailed tests
 - c. Type I and II errors
 - d. t-test (small v. large sample sizes)
 - Degrees of freedom
- 9. Correlation and regression (2 weeks)
 - a. Scatter plots
 - Correlation coefficient
 - Regression (line of best fit)
 - Multiple regression
- 10. Chi-square tests (2 weeks)
 - a. Goodness of Fit test
 - b. Test of Independence
 - c. Contingency Table

THIS COURSE WILL PREPARE STUDENTS FOR THE HSEE AND/OR FCUSD EXIT EXAM IN:

Math

LAB FEE, IF REQUIRED: None

SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

Selected math standards from Algebra 1 & 2, Geometry, Statistics and Probability

DISTRICT ESLRs TO BE ADDRESSED:

When students exit a secondary mathematics course, they will be:

- **Self-directed Learners** who will be able to use notes and a textbook to assist them in continuing their learning outside of the classroom setting.
- **Efficient Communicators** who can explain mathematical concepts to others and use mathematics to organize and explain data.
- **Quality Producers** who understand the importance of neat, organized work that demonstrates their thinking and understanding of the solution they've formed to solve a problem.
- **Constructive Thinkers** who are able to attack problems with organization, logic, and mathematical skills they've developed in a systematic fashion.
- **Collaborative Workers** who can work in a variety of settings in culturally diverse groups. They will be able to form and use study groups to strengthen their own understanding in addition to providing the same service for classmates.
- **Responsible Citizens** who accept the consequences of their actions and who demonstrate their understanding of their role in the learning process.