

# MATH 17 : AN INTRODUCTION TO EXPLORATION, CONJECTURE, AND PROOF IN MATHEMATICS

California State University, Sacramento · Department of Mathematics & Statistics

This course is designed to introduce you to the spirit of mathematics. The focus of the course is the mathematical process of exploration, conjecture, and proof. The students will learn that “doing mathematics” involves much more than memorizing algorithms and calculating numerical values. The students will explore mathematical patterns and relations, formulate conjectures based on their explorations, and learn how to prove (or disprove) their conjectures.

The primary emphasis of this course is the involvement of the students in all aspects of the mathematical process. This means that the lecture method, with its focus on teaching as an information-delivery technique, will not be the primary mode of instruction for the course.

Another important aspect of the course is its writing component. Homework assignments will emphasize exercises in which the students are required to express their ideas in clear well-organized English prose. Students will be given periodic writing assignments which encourage them to think through concepts of the course.

The content of this course should be mathematically sound and rich as well as pertinent to the K-9 curriculum. Areas of mathematics from which content may be derived include number theory, statistics, probability, sequences and series, and geometry.

## CATALOG DESCRIPTION

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Prepares students for Math 107A and Math 107B. Students will explore mathematical patterns and relations, formulate conjectures, and prove their conjectures. Topics from number theory, probability and statistics, and geometry. **Graded:** Graded Student. **Units:** 3.0.

## PREREQUISITES

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Math 9 or three years of high school mathematics which includes two years of algebra and one year of geometry; completion of the ELM requirement and a passing score on the Intermediate Algebra Diagnostic (IAD) test.

## LEARNING OBJECTIVES

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- Explore mathematical patterns and relations
- Formulate conjectures based on their explorations
- Construct logical arguments to prove or disprove their conjectures
- Present the conclusions from their explorations, formulations, and proofs in clear well organized English prose

## TOPICS THAT SHOULD BE COVERED ARE:

### Number Theory

Divisibility, greatest common divisor, division algorithm, Euclidean algorithm, primes

### Statistics

estimators, presentation of data, measure of central tendency and dispersion

## ADDITIONAL TOPICS MAY INCLUDE:

### Probability

geometric probability (“Buffon Needle/Noodle Problem”, “Buffon Coin/Blob Problem”), relative frequency experiments, methods of counting, sample spaces, joint events, independent events, simulation techniques

### Sequences and Series

“handshake” problems, “pizza-cutting” problems, “equidissectable sets”, “bouncing ball” problems

### Geometry

“Shortest path” problems (“Heron’s Problem”), Eulerian paths, Euler’s formula for polytopes, application of graphs, Hamiltonian paths, “Sperner’s lemma” (divided segments and divided triangles)

## AREA B-4 MATHEMATICAL CONCEPTS AND QUANTITATIVE REASONING STUDENT LEARNING OUTCOMES

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Students will be able to:

1. Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments.
2. Make valid inferences from numerical, graphical and symbolic information.
3. Apply mathematical reasoning to both abstract and applied problems, and to both scientific and non-scientific problems.

## WRITING COMPONENT

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This is an area B4 GE course and has a writing component. To satisfy the writing requirement graded assignments involving writing and understanding of complex technical prose, interpretation of theoretical ideas, and the use of mathematical ideas will be part of the course.