

College of San Mateo
Official Course Outline

1. **COURSE ID:** MATH 145 **TITLE:** Liberal Arts Mathematics

Units: 3.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; and 96.0-108.0 Homework hours

Method of Grading: Letter Grade Only

Prerequisite: MATH 120 or placement by other college approved methods.

2. **COURSE DESIGNATION:**

Degree Credit

Transfer credit: CSU; UC

AA/AS Degree Requirements:

CSM - COMPETENCY REQUIREMENTS: C1 Math/Quantitative Reasoning Basic Competency

CSM - COMPETENCY REQUIREMENTS: C3 Information Competency

CSM - GENERAL EDUCATION REQUIREMENTS: E2b. Communication and Analytical Thinking

CSU GE:

CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B4 -

Mathematics/Quantitative Reasoning

IGETC:

IGETC Area 2: MATHEMATICAL CONCEPTS AND QUANTITATIVE REASONING: A: Math

3. **COURSE DESCRIPTIONS:**

Catalog Description:

An examination of important concepts of mathematics and of mathematics as a tool for decision making. Topics and applications may include aspects of the history of mathematics, problem solving, counting methods, elementary number theory, sets, Euclidean and non-Euclidean geometry, Platonic solids, topology and logic.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**

Upon successful completion of this course, a student will meet the following outcomes:

1. Clearly describe the application of and model a variety of modes of thinking to deduce and to solve mathematical problems, may include: a. Numerical estimation b. Proof by contradiction, and other methods of proof c. Identification of mathematical patterns d. Using analogy (a simpler version of a complex mathematical idea) e. Examination of familiar mathematics from a fresh perspective f. Using recursive (or iterative) processes g. Employing reflective trial and error in mathematical problems
2. Examine the same mathematics from various points of view, and describe or explain what is common to the points of view and what is specific.
3. Demonstrate Information Competency Skills as applied to presentation of a mathematical topic:, specifically: a. Determine the extent of information needed to present the selected topic. b. Access the needed information effectively. c. Evaluate information and its source critically. d. Explain connections between selected information and previous mathematical knowledge. e. Use information effectively in presentation of materials. f. Show evidence of understanding of economic, legal, and social issues surrounding the use of information by accessing and using information ethically and legally.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**

Upon successful completion of this course, a student will be able to:

Clearly describe the application of and model a variety of modes of thinking to deduce and to solve mathematical problems including: a. Numerical estimation b. Proof by contradiction, and other methods of proof c. Identification of mathematical patterns d. Using analogy (a simpler version of a complex mathematical idea) e. Examination of familiar mathematics from a fresh perspective f. Using recursive (or iterative) processes g. Employing reflective trial and error in mathematical problems
Examine the same mathematics from various points of view, and describe or explain what is common to the points of view and what is specific.

1. Demonstrate Information Competency Skills as applied to presentation of a mathematical topic by showing skill in: a. Determining the extent of information needed to present the selected topic. b. Accessing the needed information effectively and efficiently c. Evaluating information and its source critically. d. Incorporating selected information into personal knowledge base. e. Using information effectively in presentation of materials to the class. f. Showing evidence of understanding of economic, legal, and social issues surrounding the use of information, and accessing and using information ethically and legally.

6. COURSE CONTENT:

Lecture Content:

1. Problem Solving using mathematical puzzles to see patterns and develop strategies.
2. Number Theory
 - A. Natural numbers, prime numbers and patterns
 - B. Rational and irrational numbers
 - C. Fibonacci and other sequences
3. Finite and infinite sets
 - A. Basic notions of set theory
 - B. Cardinality, and determining whether two infinite sets are of equal cardinality
 - C. Cantor sets
4. Geometry
 - A. Euclidean geometry (including Platonic solids, the Golden ratio, and proofs of the Pythagorean Theorem)
 - B. Non-Euclidean Geometry
5. Other topics
 - A. Complex Numbers
 - B. Fractals and chaos
 - C. Probability and Statistics
 - D. Voting systems and fair division of resources
6. History of mathematics (Typically, the history of the development of the various topics is treated as the topics are treated)

7. REPRESENTATIVE METHODS OF INSTRUCTION:

Typical methods of instruction may include:

- A. Lecture
- B. Discussion
- C. Other (Specify):
 - A. Instructor prepares and chooses out-of-class assignments (exercises and readings) to be completed by students either online or in written form.
 - B. Guided discussion of topics either in class or online, and lectures and explanations to clarify hard-to-grasp concepts.
 - C. Written essay assignments incorporating mathematical modeling or exposition of applications of mathematics. Typically, students are asked to write up several (often three) short essays on set questions that the instructor determines are doable and to put together a larger project that may be presented to the class as a whole.
 - D. Critical thinking: Small group problem solving proposed solutions are evaluated in light of constraints of the problem.
 - E. Resources available on CD and the Internet may be used to supplement the text.

8. REPRESENTATIVE ASSIGNMENTS

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

There are 3 to 4 essays and a final project. Essays are individual writings, the final project is collaboratively produced by groups of 2 to 4 students.

Example 1: 3rd Out of Class Essay

3 to 5 pages, typed, double spaced with a page of explanatory illustrations either spread through the text or as a separate sheet. Title your illustrations so that it is easy to know which one you are referring to in the text of your paper. Use MLA style citations.

Be sure that your introductory paragraph includes a thesis statement. In mathematics a thesis statement may lay out where the paper is going and what the key elements of the argument or discussion will be. If appropriate it may be a statement of what is to be proved.

Your audience is a student at CSM who has not taken this course, so do not presuppose knowledge of the subject other than a typical high school education.

TOPIC: The Platonic Solids

Define and name the Platonic Solids

Explain the concept of duality of Platonic Solids and how it is related to the number of faces and the number of vertices.

Answer the question, "Are there any more platonic solids?" both geometrically and algebraically. Explain how the video determined that there were not any more Platonic Solids.

Explain how the Euler Characteristic Theorem verifies that there are not any more Platonic Solids.

Example 2: Essay 2

TOPIC: Multiple Infinities

Write a letter convincing a skeptical friend that infinity does indeed come in different sizes. Convince him/her that there are indeed more real numbers than natural numbers. Furthermore, convince him/her that there are sets larger than the set of real numbers.

With in your letter use good mathematical vocabulary, define the ideas of cardinality, one-to-one relationship, diagonalization method (Cantor) and discuss at least different three sizes of infinity.

Reading Assignments:

Typical reading assignments are a portion of the text in support of the current topic.

Other Outside Assignments:

Outside assignments include homework problems, viewing videos that support or supplement understanding of the current topic.

9. REPRESENTATIVE METHODS OF EVALUATION

Representative methods of evaluation may include:

- A. Class Participation
- B. Exams/Tests
- C. Group Projects
- D. Homework
- E. Quizzes
- F. Written examination
- G. A. Completed individual assignments and/or journal either in paper form or written online: to demonstrate individual student progress toward objectives. B. Small group presentations: to reflect student participation in problem solving process. C. Written exams/quizzes: to demonstrate student knowledge of vocabulary, concepts, and application of concepts to problem solving as presented in lectures and discussion, small group sessions, and text readings. D. A Final Examination or Final project: to demonstrate student knowledge of vocabulary, concepts, and applications of concepts to problem solving as presented in classwork for the entire course, or to demonstrate the ability to apply what has been learnt to a topic "not covered" in the normal class work. The instructor may determine a number of feasible projects from which students or groups of students choose to develop a Final Project. E. Participation: to reflect student involvement in class discussions, in small group sessions and in presentations.

10. REPRESENTATIVE TEXT(S):

Possible textbooks include:

- A. Tannenbaum, Peter. *Excursions in Modern Mathematics*, ed. Pearson, 2017
- B. Burger, Edward B and Michael Starbird. *The Heart of Mathematics: An Invitation to Effective Thinking*, ed. John Wiley and Sons, 2020

Other:

- A. Lippman, David Math in Society downloadable free at <http://dlippman.imathas.com/mathinsociety/index.html> or in paper form from: <http://www.lulu.com/shop/david-lippman/math-in-society/paperback/product-15218575.html>

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Course Originator: Christopher Walker