MA 145 # *Liberal Arts Mathematics* **Spring 2009**

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Units of Credit: 3 Lecture hours/week: 3 + a one hour lab by arrangement per week.

Prerequisites: Successful completion of Math 120 with a grade of C or better. You will find that the text really does assume that you learned the contents of Intermediate Algebra. Since you have probably not been using that material, you will probably have to review or relearn some of it. In class, we will give brief reviews of the required mathematics, but we will not re-do Math 120.

Student Learning Outcomes: The student will be able to:

1. Employ trial and error as a problem solving technique. [Learn from mistakes in problem solving and use the knowledge to modify approach]
2. Clearly describe the process and/or necessary background material that lead to the solution of a problem.
3. Use estimation to move from qualitative to quantitative reasoning.
4. Explain the logic of a proof by contradiction.
5. Demonstrate how to find patterns by looking at simple things deeply and use them to gain further insight.
6. Model or explain by example how one examines building blocks of a complex structure to answer questions, generate new questions, and discover new understanding.
7. Model or explain by example how one examines the familiar in a new ways in a quest for new insights and follow new ideas to a logical conclusion, even when the conclusion seems counterintuitive.
8. Use precise definitions correctly.
9. Explain examples that show the power of recursive (iterative) processes
10. Examine the same problem from various points of view and describe or explain the common concepts.
11. Explain by example how one attempts to understand difficult ideas or complex systems by examining carefully a simpler version of the idea or system and using analogy to gain insight about the greater challenge.

Course Description: We will consider some of the greatest ideas of humankind. The great ideas we will explore are within the realm of mathematics - an artistic endeavor that requires both imagination and creativity. In this course, we will experience what mathematics is all about by investigating some beautiful and intriguing issues. Thus, the informal prerequisites for this course are an open and curious mind and the willingness to put aside any preconceived prejudices or dislikes for mathematics.

We will cover roughly six different topics. The overriding theme of the course is to gain an appreciation for mathematics and to discover the power of mathematical thinking in your everyday life. Expect to be challenged intellectually. We will follow the text reasonably closely although we will not cover all the material in class.

Assessment: There are **3 scheduled tests, 3 out-of-class essays** and a **cumulative final exam/project**. Make-up tests are not usually given. If a student is going to miss a scheduled test because of illness or legal obligation (court appearance, jury duty), the instructor must be notified **prior** to the student missing the test. The student may call, leave a voice mail, or email. There may be **unannounced quizzes or other graded in-class activities**. These cannot be made up.

Students are expected to work on homework and reading assignments as assigned. Daily consistent effort is essential. Students should check the homework hints and solutions given in the text. *Clarity of exposition is important*, and **well-written, polished solutions** are the goal**.** For the most part, collaboration on homework with other members of this class is allowed, although solutions must be individually written up and collaborators ***should be acknowledged*****.** Discuss the problems with your study group, utilize the math lab (18-202) to work with a tutor, or visit the instructor during office hours. Homework is due the day announced on the course calendar unless a change is announced in class. Late homework is not accepted.

Hour by Arrangment: This course includes an additional hour by arrangement. Students are expected to complete one additional hour per week (by arrangement) in some verifiable way. This can easily be done by visiting (and logging in at) the Math Resource Center (18-202) or in 16-111 on Tuesday, Thursday at 9.00 or Friday from 10.00 – 13.00.

Research Project/Poster-PowerPoint Session: The only way to really understand mathematics is to learn and discover it on one's own. Thus, students will select a mathematical topic not covered in our class, read and teach themselves any necessary background to understand it, and then investigate the topic. (There will be sufficient textbook material for students to choose text topics not formally covered in class for this project) Students are **strongly** encouraged to work together in groups of two or three. By working together, the individuals can learn from each other and share the experience. Each group will write a final paper on their findings and present a poster/power-point talk during a class project session at the end of the semester. Also, each student will write a short individual statement about the experience. Various interim reports will be collected throughout the term.

Disability Policy Statement: *If you have a documented disability and need accommodations for this class, please see me as soon as possible or contact the Disability Resource Center (DRC) for assistance. The DRC is located in Bldg. 16 Room 150. (650) 574-6438; TTY (650) 574-6230 Confidentiality*. Students with disabilities are protected under Family Education Rights and Privacy Act (FERPA). Please understand confidentiality and do not identify the person or their disability information to other students.
Taping Lecture. Students who are unable to take or read notes have the right to tape record class lectures only for their personal study.

Plagiarism/Cheating Policy Statement : Students are encouraged to work together on class-work and homework. However, simply copying someone's assignment without actively participating in its production is not acceptable. Students are expected to work independently on quizzes and tests. Source citation will be required for the written projects. Appropriate methods will be discussed at that time.

Grading Policy: Your grade will be a weighted average: 3 Essays (30%), 3 Tests (30%), Homework (10%), HBA and class work (10%), Final Project (20%).

Required materials:
Text: *The Heart of Mathematics: An invitation to effective thinking*,
2nd edition, by Edward B. Burger and Michael Starbird

Special assignment due second day—Read Section 1.1 and start Stories 1, 3, 4, 5, 7, and 8 (You may read Section 1.2 (hints), but do not read Section 1.3 (solutions)).

A1— Finish Section 1.1 Stories 1, 3, 4, 5, 7, 8, and also do Stories 2 and 6.
Read Section 1.4 and do Mindscapes ,6, 7, 9, 14. [4]

A 2— Read Section 2.1 and do Mindscapes 4, 8, 15.
Read Section 2.2 and do Mindscapes 2, 6, 7, 15 22, 29, 30, 36
Read Section 2.3 and do Mindscapes 2, 7, 12, 14, 15, 24, 32, 35
Read Section 2.6 and do Mindscapes 3, 6, 10, 30, 40.
Read Section 2.7 and do Mindscapes 2, 7, 10, 20, 23, 25 [30]

A 3— Read Section 3.1 and do Mindscapes 3, 4
Read Section 3.2 and do Mindscapes 3,14,16,30, 32, 36
Read Section 3.3 and do Mindscapes 4, 11, 9, 13, 14, 16, 17, 19
Read Section 3.4 and do Mindscapes 4, 6, 13.
Read Section 3.5 and do Mindscapes 2, 6, 9, 10, 20 [23]

A 4— Read Section 4.1 and do Mindscapes 2, 8, 12, 15.
Read Section 4.3 and do Mindscapes 3, 9, 12, 16, 17, 20.
Read Section 4.5 and do Mindscapes 2, 16, 17.
Read Section 4.7 and do Mindscapes 1, 7, 12, 14, 16, 18. [19]

A 5— Read Section 4.6 and do Mindscapes 3, 4, 13, 16, 19, 26, 30
Read Section 5.2 and do Mindscapes 3, 6, 8, 9, 25, 33.
Read Section 5.3 and do Mindscapes 2, 7, 9, 13, 26, .40. [19]

A 6— Read Sections 6.1 and 6.2 and do Section 6.2 Mindscapes 2, 8, 12, 13, 27, 28.
Read Section 6.3 and do Mindscapes 3, 6, 13, 14, 20, 21, 23, 24, 25, 26, 27, 40 [18]

A 7—. Read Sections 7.1 and 7.2 and
do Section 7.2 Mindscapes 2, 7, 8, 9, 12, 18, 19, 20, 28, 30, 40
Read Section 7.3 and do Mindscapes 2, 23, 26, 30, 32.
Read Section 7.4 and do Mindscapes 10, 12, 15, 19 [19]

Homework Solutions and other Course Materials are posted on

http://www.smccd.edu/accounts/csmws/

Detailed SLO with connections to course material:

	SLO	Mathematical context
1.	Employ trial and error as a problem solving technique. [Learn from mistakes in problem solving and use the knowledge to modify approach]	Traditional math puzzles; demonstrated in process of determining cardinality of infinite sets
2.	Clearly describe the process and/or necessary background material that leads to the solution of a problem.	Essays and final projects
3.	Use estimation to move from qualitative to quantitative reasoning.	Counting, Pigeon hole principle
4.	Explain the logic of a proof by contradiction	Proof that the square root of 2 is irrational
5.	Demonstrate how to find patterns by looking at simple things deeply and use them to gain further insight.	Numerical Patterns in Nature; Fibonacci Sequence, Phi, Golden Ratio; Platonic Solids, duality, Euler's connectivity theorem; Sample spaces, probability, expected values
6.	Model or explain by example how one examines building blocks of a complex structure to answer questions, generate new questions, and discover new understanding.	Prime numbers, natural numbers, rational numbers, irrational numbers, real numbers [*optional topics for final projects – modular arithmetic; RSA public key cryptography*]
7.	Model or explain by example how one examines the familiar in a new ways in a quest for new insights and follow new ideas to a logical conclusion, even when the conclusion seems counterintuitive.	Counting, one-to-one correspondence, cardinality sets, relative cardinality of points on line segment, ray, line, circle Cardinality of sets (and subsets) of natural numbers, rational numbers, real numbers, Cantor's Diag. Theorem; Cantor's Power Set Theorem.
8.	Use precise definitions.	Sets, sub-sets, cardinality of infinite sets
9.	Explain examples that show the power of recursive (iterative) processes	Cantor's power set theorem; division algorithm; construction of fractals- Koch curves, Sierpenski carpet, fractal like structure in nature; complex faction representation of phi.
10.	Examine the same problem from various points of view and describe or explain the common concepts.	Fibonacci numbers, phi, geometry of golden ratio; platonic solids and networks; Pythagorean Proofs. [*optional topics for projects – non-Euclidean geometries]*
11.	Explain by example how one attempts to understand difficult ideas or complex systems by examining carefully a simpler version of the idea or system and using analogy to gain insight about the greater challenge.	Dimensions – 1, 2, 3, and 4; fractals; Mobius band -> Klein bottle.