Program Cover Sheet
MAT 150: Classical Mathematics of the Mediterranean Region

I. Basic Course Information

MAT 150 is intended primarily as a Quantitative Reasoning course for non-science majors. It will be scheduled for two 80-minute lecture periods. It has no prerequisites.

II. Learning Goals

The foundations of modern mathematics were formed in the ancient world. During the Bronze Age in Mesopotamia the roots of modern computational math were developed. The Classical period of Greece saw the birth of theoretical math. It is generally assumed that mathematics starts off primitive and each new generation adds new results to the ever expanding body of knowledge. This is simply not true. The rise of mathematics is far from linear. What is considered mathematics, what are valid arguments and what are the motivations to perform mathematics changes rapidly. We will see that the answer to these questions varies depending on the needs, outlook and culture of the individuals involved.

The goal of this course is to have students develop a deep understanding of the changing perspectives of mathematics. To accomplish this they will master a number of ancient techniques and forms of reasoning. In addition, students should understand why these methods are valid. Finally they should understand the historical context of the mathematics and how it contributed to the development of western thought.

III. Student Assessment

Students will receive regular feedback on their work through the assignment of homework, quizzes, student presentations and/or examinations. Through this feedback, students will be able to see and correct their misunderstandings and improve their performance. Peer reviews and student evaluations will also be used to evaluate the course.

IV. Learning Activities

Learning activities will consist of a combination of lectures, group work, student presentations, and/or written assignments. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and/or group homework to achieve the learning goals.

Departmental Course Syllabus
MAT 150: Classical Mathematics of the Mediterranean Region

I. Basic information on course and instructor

A. Purpose statement: This class introduces students to a variety of forms of mathematics prominent in the Classical period. Through this they will gain an appreciation of how mathematical perspective changes. They will also learn how physical needs, historical events and philosophical outlook guide these changes.

B. Course description: An introduction to Classical mathematics. A variety of topics will be covered from this period. Such topics could include Mesopotamian computation, Mesopotamian problem tablets, Thales' geometry, Pythagorean monads, Pythagorean music, ancient number theory, proportions and geometry, the paradoxes of Parmenides and Zeno, geometric construction, geometrical measure, Greek astronomy, Greek trigonometry, Archimedes' measure and the decline of Greek reasoning.

C. Course prerequisites: None.

II. Learning goals

A. Content goals: Students will learn a number of ancient mathematical methods and their justification. Students will learn a brief intellectual history of the period, focusing on the place of mathematics within it.

B. Performance goals: At the completion of the course, students should demonstrate competence in a number of ancient mathematical methods. They should be able to explain the reasoning behind these methods. Their exposition should be mathematically correct, logically organized and stylistically clear.

III. Student assessment

A. Assessment plan: Students will receive regular feedback on their work through the assignment of homework, quizzes, projects, student presentations and/or examinations. A syllabus should clearly describe the schedule for these assessment tools and how they will be used to calculate grades.

B. Rationale: Through the use of regular feedback from homework, quizzes, student presentations and/or examinations, students will be able to see and correct their misunderstandings and improve their performance.

C. Methods and criteria: We will use the assessment of homework, quizzes, projects, student presentations, and examinations to evaluate student accomplishment of the course learning goals.

IV. Learning activities

A. Summary of learning activities: Learning activities will consist of a combination of lectures, group work and/or student presentations. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and/or group homework to achieve the learning goals.

B. Calendar or outline: A guide to the organization of the course, a schedule of assessment tools, and a plan for the coverage of topics should be provided to the students. Homework, quizzes, and examinations should be spaced at appropriate intervals throughout the semester.

C. Rationale By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of Classical mathematics and ancient reasoning and contribute to the learning goals of quantitative reasoning. A regular spacing of assessment tools insures that students receive continual regular feedback on their work.

Sample Syllabus from Actual Course
Professor Reimer
Spring 2011

Syllabus

Classical mathematics

Course: Math 150; section 1
Time: Mondays and Thursdays 10:00-11:20
Room: SCP 230

Instructor: Dave Reimer
Office: SCP 211
Phone: 771-2382
E-mail: dreimer@tcnj.edu
Office Hours: Tuesdays 11:00 - 12:30 and Wednesdays 9:30 – 11:00. Also, other times by appointment.

Course Description: The foundations of modern mathematics were formed in the ancient world. During the Bronze Age in Mesopotamia the roots of modern computational math were developed. The Classical period of Greece saw the birth of theoretical math. It is generally assumed that mathematics starts off primitive and each new generation adds new results to the ever expanding body of knowledge. This is simply not true. The rise of mathematics is far from linear. What is considered mathematics, what are valid arguments and what are the motivations to perform mathematics changes rapidly. We will see that the answer to these questions varies depending on the needs, outlook and culture of the individuals involved.

Many courses in the history of mathematics pick out and explore a number of ancient problems that are interesting from a modern perspective. We will not do this. What's interesting to a modern may not even matter to an ancient. Modern mathematics is dominated by functions and algebra, concepts that didn't even exist until Europe's Age of Reason. Using equations to examine ancient math makes as much sense as describing how the Egyptian Pyramids were built using jackhammers and other power tools. Rather than focus on specific problems we will concentrate on how the ancients approached mathematics. What motivated their problems? How did they express them? What general methods were used to derive solutions?

Below is a brief outline of the topics covered in this course. It may be pared down depending on how fast we progress.

Calculi and Mesopotamian Computation

Here we will see how the modern place value system arose out of the use of calculi. The rise of civilization and the city-state, guides the evolution of these mobile tokens. The needs of the legal system transform calculi into a written language. As numbers become written instead of held, they progress toward the modern place value system.

Mesopotamian Tablets

The first mathematical procedures expressed in writing appear on Babylonian clay tablets. We will examine how they were used and how they act as a substitute for modern equations.

Thales

Thales is the first known Greek mathematician. He is also the first known mathematician to change the question from *what is the answer* to *why is that the answer*. Thales looks at simple questions that appear obvious but require complex justifications in the world's first known proofs. We will examine why this unique perspective arose in the Greek world.

Pythagoras and Monads

The early Pythagoreans invented and studied Number theory in an attempt to understand the nature of god and the universe. They did so by examining the mathematical properties of music and diagrams made of pebbles which represented monads. We will see that their studies in numerology lead to some very sophisticated mathematics such as perfect numbers and the irrationality of the square root of two.

Proportions and Geometry

There are questions of proportions raised by the theory of music that cannot be answered with number theory but can be answered with geometry. We will divide up the musical scale using geometric means, construct square roots, prove the Pythagorean Theorem and derive the properties of the golden mean.

Parmenides, Zeno, Geometric Constructions and Existence

The Elatic philosophers questioned the very nature of reality. Their arguments brought about the rise of the dialectic, which modern mathematicians call *proof by contradiction*. Here we will examine arguments that seem to undermine our very existence, why these arguments are uniquely Greek and how these are not even sufficiently answered today.

Measure and Geometry

As the Greeks moved from number theory to geometry new questions arose. It's easy to add two numbers, but how do you "add" two shapes like a rectangle and a triangle. Here we will examine

the basic mathematical operations as the Greeks viewed them in terms of geometry. We will then combine the operations to derive some arithmetical relations.

Greek Astronomy

Returning to the practical roots of mathematics we will understand and repeat Greek methods for determining the size of the Earth, Moon and Sun and how far away they are from each other.

Chords and Diagrams

Today trigonometry consists of lists of functions and equations. Here will see that the origins of trig were quite simple, derived from a few diagrams. We will solve trigonometric relations geometrically with almost no memorization and outline how Hipparchus and later Ptolemy constructed a table of trig values.

Archimedes and Calculus

Two thousand years before Newton, Archimedes was playing with some of the basic notions of calculus. We will examine inspired arguments finding area of a circle and the volume and surface area of a sphere. We will see how, like a modern physicist, Archimedes used thought experiments to express and derive mathematical ideas. We will also discuss why these notions were largely ignored.

The Death of Greek Math

What forces cause the death of one of the most productive eras in mathematics? We will also discuss how Greek ideas made it into the modern world.

Text: Lecture notes provided by the instructor.

Problems: There are problems for each chapter. Students are encouraged to try every problem in the text. I will choose several of these that are indicative of our focus.

Tests: There will be two in-class tests given this semester. The dates for these are 2/24 and 4/1. Make-up tests will be given only in extreme circumstances and by prior arrangement. You must let me know as soon as possible if you will not be able to take a test when it is scheduled. There will also be a cumulative final exam given during the exam period at the end of the semester.

Grading: The two in-class tests will account for fifty percent of your grade, quizzes for ten percent and the final will account for thirty percent. The remaining ten percent of your grade will be determined by class participation. For this grade you will be expected to present your fair share of solved homework problems and to regularly contribute to class room discussion.

SELECTED TCNJ POLICIES

TCNJ's final examination policy is available on the web:
http://www.tcnj.edu/~academic/policy/finalevaluations.htm

Attendance

Every student is expected to participate in each of his/her courses through regular attendance at lecture and laboratory sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. At the first class meeting of a semester, instructors are expected to distribute in writing the attendance policies which apply to their courses. While attendance itself is not used as a criterion for academic evaluations, grading is frequently based on participation in class discussion, laboratory work, performance, studio practice, field experience, or other activities which may take place during class sessions. If these areas for evaluation make class attendance essential, the student may be penalized for failure to perform satisfactorily in the required activities. Students who must miss classes due to participation in a field trip, athletic event, or other official college function should arrange with their instructors for such class absences well in advance. The Office of Academic Affairs will verify, upon request, the dates of and participation in such college functions. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

Students are expected to attend class and complete assignments as scheduled, to avoid outside conflicts (if possible), and to enroll only in those classes that they can expect to attend on a regular basis. Absences from class are handled between students and instructors. The instructor may require documentation to substantiate the reason for the absence. The instructor should provide make-up opportunities for student absences caused by illness, injury, death in the family, observance of religious holidays, and similarly compelling personal reasons including physical disabilities. For lengthy absences, make-up opportunities might not be feasible and are at the discretion of the instructor. The Office of Academic Affairs will notify the faculty of the dates of religious holidays on which large numbers of students are likely to be absent and are, therefore, unsuitable for the scheduling of examinations. Students have the responsibility of notifying the instructors in advance of expected absences. In cases of absence for a week or more, students are to notify their instructors immediately. If they are unable to do so they may contact the Office of Records and Registration. The Office of Records and Registration will notify the instructor of the student's absence. The notification is not an excuse but simply a service provided by the Office of Records and Registration. Notifications cannot be acted upon if received after an absence. In every instance the student has the responsibility to initiate arrangements for make-up work.

TCNJ's attendance policy *is available on the web:*
http://www.tcnj.edu/~recreg/policies/attendance.html

Academic Integrity Policy

Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic dishonesty, whether the work is graded or ungraded, group or individual, written or oral.

TCNJ's academic integrity policy *is available on the web:*
http://www.tcnj.edu/~academic/policy/integrity.html.

Americans with Disabilities Act (ADA) Policy

Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy is available on the web: http://www.tcnj.edu/~affirm/ada.html