Montserrat 109N – Mathematics Across Cultures
Syllabus – Spring 2010

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Course Homepage: `http://mathcs.holycross.edu/~little/Montserrat1011/Spring.html`

Food For Thought

> No society, however small or remote, has ever lacked the
> basic curiosity and "number sense" that is part of
> the global mathematical experience.
> *G.G. Joseph, The Crest of the Peacock, p. 512*

Course Description

Where did the arithmetic, algebra, and geometry that we all learn come from? Who invented (or discovered?) this material and when and why did it happen? In the fall semester, we addressed these and other questions through a study of several topics from basic algebra and geometry – most notably

- the solution of quadratic equations by techniques including the *quadratic formula* from algebra, and
- the *Pythagorean theorem* from geometry.

We presented a fairly standard "modified Eurocentric" account of this, showing how the mathematical ideas of the ancient Egyptians and Babylonians were expanded and developed by the Greeks through the classical and Hellenistic periods, codified in the *Elements* of Euclid, then transmitted to modern Europe by way of the medieval Islamic caliphates (especially the center of learning at Baghdad) and finally extensively reexamined and greatly extended (in particular through the discovery of non-Euclidean geometries) in modern Europe.

This semester, we will continue our study of mathematics across cultures and through time. We will begin by casting our net quite a bit wider and looking at how "mathematical thinking" can be found in many aspects of diverse cultures from all over the world:

- in the ways people have conceptualized and developed systems for recording and measuring the passage of *time*,
- in the ways people have developed maps and models for the organization of *space* for orientation and navigation,
- in the ways people have created *games and puzzles*,

- in some of the ways people have used ideas of symmetry and other mathematical structures to create *decorative elements in architecture, textiles and other everyday artifacts, art and music.*

Why is this important? The examples we will look at should be pretty strong evidence for accepting the basic premise from G.G. Joseph's book articulated above. And if we accept that, then we open ourselves to the possibility that perhaps our "modified Eurocentric" account of the history of mathematics needs to be modified *even more* in order to obtain a more historically accurate picture of *the global mathematical experience*! We will close out the semester and the year by seeing how Indian, Chinese, and Islamic mathematicians were often centuries ahead of their European counterparts and consider how even the "modified Eurocentric" picture is something of a distortion because it obscures when and where important ideas were first developed.

Course Objectives

The major objectives of the course will be:

1) To examine examples of mathematical thinking across cultures and through time to understand how and why those ideas were developed.
2) To deepen your understanding of mathematics as an area of human study.
3) To further your development as writers and speakers.
4) To participate in and contribute to the common activities of the Natural World Cluster of the Montserrat program –
   (a) Medical Ethics Presentation – Thursday, February 17 (7:30 - 8:30pm).
   (b) Boston "Emerald Necklace" Conservancy and Museum trip – Saturday, April 16 (full day).
   (c) Natural World Cluster End-of-Year Dinner – Monday, May 2 (5 - 7pm).

Texts

The main mathematical texts for the course are:

1) G. G. Joseph, *The Crest of the Peacock*, Princeton University Press.
2) M. Ascher, *Mathematics Elsewhere*, Princeton University Press.

We will also read and discuss some sections of the Natural World Cluster common reading:

2) J. Diamond, *Collapse*, Penguin Books.

Course Schedule

A detailed day-by-day course schedule and listing of required and suggested outside events will be maintained on the course homepage. That listing is a tentative, evolving schedule, so you will probably want to refer to it frequently. Any important changes will also be announced in class well in advance.

Assignments and Grading

1) Midterm Exam (20 % of course grade) – tentative date: Friday, March 18.
2) Final Project and Presentation (30 % of course grade) – The major assignment this semester will be a research project done in pairs, and leading to a longer paper (about 15 to 20 pages) and an oral presentation of roughly 20 minutes. The presentations will be given the final two weeks of the semester.
3) Problem Sets (about 6 through the semester – 10 % of course grade)
4) In-class group work (about 6 assignments – 10 % of course grade)
5) Two shorter (roughly 5 page) papers related to the readings and other topics. (More information and guidelines to be distributed later) (25 % of course grade)
6) Class participation (5 % of course grade)

I will be keeping your course average in numerical form throughout the semester, and only converting to a letter for the final course grade. The course grade will be assigned according to the following conversion table (also see Note below):

- A – 94 and above
- A- – 90 - 93
- B+ – 87 - 89
- B – 84 - 86
- B- – 80 - 83
- C+ – 77 - 79
- C – 74 - 76
- C- – 70 - 73
- D+ – 67 – 69
- D – 60 - 66
- F – 59 and below.

Note: Depending on how the class as a whole is doing, some downward adjustments of the above letter grade boundaries may be made. No upward adjustments will be made, however. (This means, for instance, that an 85 course average would never convert to a letter grade of B- or below, although it might be a B+ in some circumstances.) If you ever have a question about the grading policy or your standing in the course, don't hesitate to ask me.

Advice On How To Succeed In This Class

A good "work ethic" is key. As you should be able to tell from the course description above, you do not need to be a "math genius" to do well in this course. But you will need to put in a consistent effort and keep up with the reading and assignments.

Come to class. Unless you are deathly ill, have a genuine family emergency, are away at a game or meet of a college athletic team, etc. plan on showing up here at 9:00 am every Monday, Wednesday, and Friday this semester. Many of the class meetings will be structured around discussions or student presentations. Your participation is expected and needed for the success of the course!

Take notes and use them. This may seem obvious, but it is worth saying! Used intelligently, your notes can be a valuable resource as you work on problem sets and prepare for exams.

Use the texts and class notes actively. Reading about mathematics is not like reading a novel. You will probably need to read and think over things more than once. You may want to work through examples or draw your own diagrams to understand some of the Euclidean proofs that we do.

Set up a regular study schedule and work at a steady pace. It's not easy to play catch-up in a mathematics course (even when the course is part of a first-year program with additional goals beyond the mathematics). You should expect to budget at least 6 hours in a typical week for work outside of class. The best way to use your time is to do a few problems, some reading from the books, and reviewing of class notes every day.

Most importantly, if you are having difficulty learning something, get help as soon as possible. You can do this by asking questions during class (any time something isn't clear), or seeing me during office hours.

Statement on Academic Integrity

All education is a cooperative enterprise between teachers and students. This cooperation works well only when there is trust and mutual respect between everyone involved. To be become an engaged and advanced learner, you must be able to think and work both independently and in concert with your peers. The College academic honesty policy states: "As an institution devoted to teaching, learning, and intellectual inquiry, Holy Cross expects all members of the College community to abide by the highest standards of academic integrity. Any violation of academic honesty undermines the student-teacher relationship, thereby wounding the whole community. The principal violations of academic honesty are plagiarism, cheating, and collusion.

Plagiarism is the act of taking the words, ideas, data, illustrative material, or statements of someone else, without full and proper acknowledgment, and presenting them as one's own.

Cheating is the use of improper means or subterfuge to gain credit or advantage. Forms of cheating include the use, attempted use, or improper possession of unauthorized aids in any examination or other academic exercise submitted for evaluation; the fabrication or falsification of data; misrepresentation of academic or extracurricular credentials; and deceitful performance on placement examinations. It is also cheating to submit the same work for credit in more than one course, except as authorized in advance by the course instructors.

Collusion is assisting or attempting to assist another student in an act of academic dishonesty.

The full statement on Academic Honesty in the College Catalog will be posted on the Natural World/Montserrat Moodle site and is available at

http://www.holycross.edu/catalog/academic-honesty-policy.pdf

The temptation to engage in an act of academic dishonesty will almost certainly arise, but the chance to possibly enhance a single grade is not worth the loss of your personal integrity. If you do not know how to correctly cite reference materials, consult with your professor, the campus Writers Workshop, or visit one of the links below (also posted on the Natural World/Montserrat Moodle site).
Department of History:

http://www.holycross.edu/departments/history/website/academichonesty.htm

Department of English (link to Houghton Mifflin booklet, "Understanding Plagiarism: A Student Guide to Writing Your Own Work"):

http://college.cengage.com/english/plagiarism_prevention.html

Houghton Mifflin, "The Plagiarism Zone"

http://college.hmco.com/english/plagiarism_prevention.html

NOTE: If in doubt about what you plan to do or write violates academic honesty, PLEASE ASK!

Specific Guidelines for this Course

In this course, all examinations will be closed-book. No sharing of information with other students in any form will be permitted during exams. On group discussion write-ups, close collaboration with the other members of your group is expected. On the individual problem sets, discussion of the questions with other students in the class and with me during office hours is allowed, *even encouraged*. However, your final problem solutions should be prepared individually and the wording and organization of your final problem solutions should be entirely your own work. Moreover, if you do take advantage of any of the above options for discussion of problems with others, you will be required to state that fact in a footnote accompanying the problem solution. Failure to follow this rule will be treated as a violation of the College's Academic Integrity policy. For the papers, if you do consult a source other than the course texts, include a full reference in a bibliography section at the end of your paper, and identify any direct quotations. Information about the acceptable formats for doing this will be distributed with the paper assignments.