Mathematics 120
Spring, 2001

Instructor: Dr. Michael Rogers.
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WWW: `http://userwww.service.emory.edu/~mroge02/Math120/Index.html`
Hours: **M–F 2:00–3:00.** Generally available after 3:00. An appt. is surest.

Course Content: Mathematics 120 is an introduction to pure mathematics through the study of geometry and number theory.

Texts: Euclid, *Elements*,.
Diophantos, *Arithmetica.* (A copy will be provided.)
E. Landau, *Foundations of Analysis.* (We will cover only part of chapter one. One copy is on reserve in the library.)
Lobachevsky, *The Theory of Parallels.* (A photocopy will be handed out.)

Other Materials: Straightedge, compass, calculator (optional).

Course Goals: After this course, the student should have developed the following capacities: to reason about geometry and numbers, to read with greater attention to detail, to understand the elements of two of the classical liberal arts, geometry and number theory (arithmetic), to discuss differences in the ancient and modern conceptions of these arts. This course is for the purposes of liberal education. Thus its goals are the highest possible in a mathematics course. (Xylander, who produced the first German translation of Euclid in 1562 in which many of the proofs were omitted, tells us that his book was meant for the simple amateur who is of course content to know the facts without knowing how to prove them. But you are not mere amateurs. You are liberal arts students.)

Tests: Two tests will be offered. The first is currently scheduled for **Tuesday, February 20** in class. In no case will it be later than February 22. The second test will be announced a week in advance. Students are expected to take tests at the scheduled times. Any conflicts or problems will be handled on an individual basis. If a student has an excuse deemed legitimate by the instructor, arrangements will be made to take the test **prior to** the scheduled time.

Quizzes: All quizzes are announced; some may be take-home. The student must be present in class to receive a quiz unless a **prior** arrangement has been made with the instructor.

Commentaries: Commentaries are **due each week on Thursday**, excepting weeks in which there is a test and August 26. Each is to be no more than two pages, typed, double-spaced, of a 12-point font or larger, and at most 750 words. Each is to comment on the ideas in the course covered in the previous week or so. Each may provide alternate explanations of things, probe issues which cause the student confusion, amplify or clarify the successes or failures of the text, or anything which shows serious thought about some part of the course. A comment is more than an off-hand reaction like "It was interesting." A comment is to be critical or questioning, wondering or insightful, coherent and focused. Outside sources are permissible; keep in mind that each commentary will be evaluated on the quality of the student's own reflections. If outside sources are used, be sure to cite them appropriately and to avoid plagiarism as defined in the Honor Code.

Class Participation: The work done in the class meetings is part of the course work for each student. Absences and tardiness must be counted as work not done. Further each person is to be ready to participate in each class conversation. Students will be expected to present proofs at the blackboard unaided by notes or the text. Responsibility will rotate in random order throughout the whole class. A LearnLink conference, "120 Rogers", has been created within the "Oxford: Mathematics" conference for this course. Contributions to the conference count toward class participation, but they may not completely replace oral participation in class.

Class conversation, including conversation in class and in the LearnLink conference, needs to follow certain guidelines, if it is to be productive. Each person must feel free to contribute. This requires each person to be open to and willing to explore other's opinions. This is not to say that every person's opinion is equally valid. But every opinion, seriously proposed, equally merits investigation until we all can see in what ways it is valid and in what ways it is not. Each person must feel free to make a mistakes—in other words fear of mistakes will stifle the conversation. So one must not, by gesture, expression, noise, or word, belittle the remarks of another either inside or outside class. Let us also keep in mind that there is not necessarily only one correct opinion, and that opinions are not necessarily strictly correct or incorrect. Usually there are ways in which an opinion is correct and ways in which it is not. A sign of a good conversation is that it makes us want to reread the text.

To help students prepare to participate in the conversation, students will frequently be asked to hand in summaries of proofs to be covered in class. Collaboration on these summaries is encouraged. The summaries will not be graded per se, but a record of whether or not they were done will be kept. Persistently shoddy work will be brought to the attention of the student and will factor in the evaluation of the class participation component of the course grade.

Original Proofs: Propositions will be handed out which the student may attempt to prove. Such proofs are to be worked out by the student alone. The student may refer to the text used in class, any notes handed out in class, and his or her own notes. No one else's notes may be used. Such proofs may be submitted for credit any time on or before **Thursday, April 26, 2001**.

Final Examination: There will be a comprehensive final examination at the time scheduled by the registrar.

Grades: Grades will be based **roughly** on the following distribution of work:

Tests & Quizzes	30%
Class Participation	30%
Commentaries	10%
Original Proofs	10%
Final Examination	20%

The plus/minus system will be used. If the class becomes particularly small, then class participation will count more (up to 40%) and tests will count less.

Homework: Rereading. I want to point out to you at the outset the importance for you, both in this course and particularly in your future life, of the development of the skill of reading. Reading is more than sounding out and recognizing words. It is more than putting the words in a sentence together to get the meaning. In simplest terms the deepest reading is ever-mindful that the text was written by a human for a human audience and with human purposes in mind. A sensitive reader will discover these purposes, and see what evidence there is in the text that the author has these purposes and why. All this usually requires rereading. The summaries mentioned under "class participation" are intended to help you in this regard.

Mathematical writing usually lacks the poetical subtleties of irony and metaphor, but it does have its own difficulties. Words, phrases, definitions, and logic are used precisely, and the ideas fit together precisely. This requires the reader to pay close attention to detail and have a good memory. You must practice these things. The reader needs to follow the *logic* of the argument. One must pay attention to the scope of the hypotheses, that is, when the text assumes some fact and when the text stops assuming it. The subtle differences in the words "would/will" and "could/can" are important.

Course Outline: The course can be viewed as consisting of three parts, (1) an introduction to geometry, (2) an introduction to number theory, and (3) modern developments of number theory and geometry. For part (1) we will read Book I of Euclid's *Elements.* For part (2) we will read parts of Books VII and IX and parts of Diophantos' *Arithmetica.* For part (3) we will read modern approaches to arithmetic and geometry. In the first half we will read Peano's axiomatic basis for number theory (in Landau) and in the second half Lobachevsky's non-Euclidean geometry. Slightly more time will be spent on part (1) than on the others.

Other resources:

- Carl Boyer, *History of Mathematics*. For information about Euclid, Diophantus, noneuclidean geometry, Lobachevksy, Peano. Quite readable.
- Morris Kline, *Mathematical Thought in the Western World*. Similar to Boyer. The mathematical level of the writing varies, but most of material on these topics is accessible.
- Irina Bashmakova, *Diophantus and Diophantine Equations*. About Diophantus and current mathematics related to his work. Chapters 1, 2, 4, and 5 are especially accessible and relevant.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. By placing your name on such work, you pledge that the work has been done in accordance with the given instructions and that you have witnessed no Honor Code violations in the conduct of the assignment.