

Syllabus for MATH 135: First Steps into Advanced Mathematics

Spring Semester 2011

Professor: Erika L.C. King

Office: Lansing 304

Office Hours: M 1:00-3:00pm, W 2:00-4:00pm, F 1:30-3:00pm, and by appointment

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Class: held TTh 1:30pm-2:55pm in Napier 202

Textbook: *Chapter Zero: Fundamental Notions of Abstract Mathematics, 2nd edition*,
by Carol Schumacher

Website: <http://math.hws.edu/eking/math135.html>

Course Content and Organization

First Steps into Advanced Mathematics is a language course. We will be learning the precise language that produces rigorous proofs and reveals the beauty of mathematics. While some of the material will be new to you, the emphasis of the course is on process rather than content. The goal is for you to begin to produce mathematics, not just consume it. We will develop our production skills by studying the Logic, Sets, Induction, Relations and Functions chapters of the text. Exploring these topics will increase our abilities to create, read, write, speak and present mathematics.

This class will likely be very different from your previous mathematics courses partly because it will be run in a seminar style. There will be discussions, daily student presentations and small group work. Very little time will be spent in lecture. While previous courses may have challenged you to solve problems that were modifications of exercises seen before, here we begin to see that advanced mathematics requires more creativity. Here we begin to learn how to weave together sometimes seemingly unrelated facts in a logical way to create something new. You may find both the format and the work for this class very challenging and at times disconcerting. The goal is to learn to become independent mathematicians, discovering, creating and proving new ideas. While this may be daunting, keep in mind that your classmates and I are embarking on this adventure with you. I think you will find the journey very rewarding (and even enjoyable!) as long as you stay involved.

Prerequisites and Goals

In order to enroll for this class, you must have earned a C or better in MATH 131, Calculus II, or earned AP credit for the class. This course is intended for students seriously considering becoming mathematics majors or minors. As I mentioned above, the main goal is for you to begin understanding how to discover and produce mathematics on your own. Here we collect tools that will be used again in all upper level mathematics courses. These tools include the precise language of mathematics, many proof techniques, and some basic mathematical structures that will be invaluable throughout your mathematical career. Since this is such a foundational course, I expect that this course will be top priority for you this semester. Indeed you should expect to spend at least 10 to 12 hours a week on this material outside of class.

Supplies

In addition to the usual pencils, erasers and paper, you will need a composition book (spiral notebooks and three-ring binders will **not** be accepted) to use as a journal and a highlighter. Your class notes should be kept in a different notebook (of the type of your choosing) than your journal. Please also obtain access to a stapler; collected work on more than one page should be stapled before submission.

Assessment

Reading and exercises will be assigned daily. Check the course website or the posting outside my office after each class for the assignment. These assignments will be divided into three types: journal assignments, field assignments and collected assignments.

Journal Assignments: Journal assignments will be based on readings in the textbook and may include additional exercises not found in the text. Journal assignments should be completed before the beginning of the next class period.

Daily readings will usually only consist of a few pages, but should be carefully read several times. In your journal, take notes, work through all examples, keep a list of all new vocabulary, solve the exercises and prove (or if you cannot, spend a while at least thinking about) the theorems in the reading. Also include any additional thoughts and observations about the material. Occasionally there will be additional exercises assigned on our website to accompany the reading. Follow these guidelines for your journal work:

- Keep exercises, problems and proofs in the order they are assigned.
- Clearly label each problem or theorem you are working on.
- Use a highlighter to mark each label, so they are easily identifiable.
- Briefly describe the problem and/or draw a diagram if helpful/required.
- If unable to fully complete a proof or problem, show attempts and why they did not work.
- Note with whom you worked (if anyone).

The book illustrates a small number of examples and proofs, giving us the opportunity to discover and produce the rest on our own. Working through these assignments is the most important part of this course. You are encouraged to find a partner or two with whom you work **some** of this material. Many of the exercises you tackle in your journal work will be discussed in class. Take time to go back and look at your previous work and note if your proofs and solutions were correct and if not, why not. You may find a different approach to a problem than one shown in class. Remember: there is often more than one right way. Also try to use your mistakes to help you understand the material better.

Your journal should **not** contain class notes or daily collected assignments. I will collect your journal at each exam, but you should be working in your journal nearly every day. Each journal check will be worth 40 points. I will be looking for solutions/proofs to some of the exercises/theorems, but I will also be looking for overall effort put into exploring the course material.

Field Assignments: Field assignments will be given roughly every other week. They will be relatively short and you will have roughly a week to complete them. Field assignments are designed to give you opportunities to explore the breadth of the field of mathematics and what it means to

be a mathematician. Many of the field assignments will be readings taken from the book *Letters to a Young Mathematician* by Ian Stewart, a copy of which can be found on reserve in the library. You will also read some newspaper or journal articles and there will be at least one assignment asking you to explore a mathematical review database. You will write a short paper for each assignment, and discuss your findings in class. Each paper will be worth 10 points, and will be evaluated for how well it is written as well as creativity and expression of thought.

Collected Homework: Roughly twice a week you will turn in a written assignment: one due on Tuesday and one on Friday. These will ask you to demonstrate your ability to clearly and precisely express mathematical ideas in writing. This will include writing up proofs of theorems. Each proof will be assigned two grades – one grade for content and one grade for form. The content grade will reflect the extent to which the appropriate ideas are expressed in your write-up; that is, whether you understood the mathematical ideas required for the proof, and justified and explained this understanding well through appropriate proof methods. The grade for form will take into consideration clarity of expression, completeness, proper usage of both English and mathematical grammar, and whether you really said what you meant to say. In addition, **bonus** points will be given for **creative** approaches to proofs. This means that you can earn points for trying an alternate approach to a proof even if the proof itself is incomplete. Those assignments due on Tuesdays will be due by 5PM in my office. You may choose a partner or two with whom you may **discuss** the assignments that are due on Tuesdays. Be sure to note on your assignment anyone with whom you worked. Even though you discuss Tuesday assignments with others, your write-up should be completed entirely **on your own**. Take notes while discussing ideas with your classmate, but decide on the final organization and wording of your write-up on your own. Your work should be your own expression. Those assignments due on Fridays may be turned in up to 3PM in my office, and must be done **individually** without help from any other people or outside resources except your book, notes, and me. Treat them like a take home exam. All assignments should be turned in via paper and not email. Note that while assignments are due later in my office, you are always welcome to turn them in at the beginning of class. The point value of each written assignment will be determined by the length and complexity of the assignment. A written assignment will be worth between 10 and 50 points. **No late assignments will be accepted.**

Quizzes: Occasionally I may give short announced or pop quizzes to see if you are keeping up with the material. These quizzes will mainly ask you to give basic definitions and examples from topics in the reading and/or class discussions. I will let you use your journals for these quizzes, so be sure to keep up with the material and bring your journals to class. **Under no circumstances may a quiz be made up.** Quizzes will be worth 10 points.

Presentations: Much of the class will consist of students presenting their journal work to each other. You will be expected to do your share in this. Much of the time I will rely on volunteers to make presentations. This makes it possible for you to present the work about which you feel most confident. But the fact that so much of your understanding depends on this participation means that you must volunteer on a regular basis. Don't assume that because others volunteer, you (or your grade) are off the hook. I may also assign presentations ahead of time or call on students randomly. Presentations should be at least as well prepared as written work. If you are well prepared but you make an error you cannot correct at the board, you will get a second chance **without penalty** during the next class period. Like written assignments, presentations will be given a grade for mathematical content and a grade for the quality of the presentation. Each presentation will be worth 20 points, and you will be responsible for doing at least two (at least one of which must be a proof).

The person who is presenting his or her work at the board is not the only person with responsibilities in a presentation. The students sitting at their desks have as central a role to play. They

should be making clarifying suggestions, asking questions and adding comments. If I think there is clarification needed or that there is confusion about the topic at hand, I will likely ask questions of those seated rather than of the presenter, and the person I ask will likely be someone from whom we have not heard in a while.

In addition to individual presentations, there will be group presentations. Occasionally, some groups may be assigned to present and other groups may be assigned to evaluate a specific presentation. These will be worth 30 points.

Seminars: In addition to regular class time, you will be required to attend two mathematics/computer science seminar talks during the semester, at least one of which must be on mathematics. Seminars usually begin between 3pm and 5pm and last an hour (the days vary). Attendance at each talk is worth 10 points (you must be present and attentive for the entire talk to receive full credit).

Bonus: You may earn five bonus points for each additional mathematics/computer science seminar talk you attend. You may earn a maximum of 20 bonus points from seminar talks. Up to ten points can be earned for each additional presentation. There is no maximum for bonus points earned through presentations.

Your journal, collected assignments, field assignments, quizzes, presentations and seminar attendance will make up 45% of your grade.

Exams: There will be two **evening** midterm exams. The first will take place Thursday, February 24th from 7:00PM until 9:00PM. The second midterm will be Thursday, April 14th from 7:00pm until 9:00pm. Each midterm will be worth 15% of your course grade. The final exam will be Sunday, May 8th from 1:30pm until 4:30pm. There will likely be a take-home group project portion of the final. The in-class and take-home finals together will be worth 25% of your course grade. It is impossible to construct fair makeup exams in mathematics. Thus, for your protection, my policy is that there are **no** makeup exams. **You must be present for all exams.**

Attendance: Since your participation is such a large part of the class, absences will greatly affect your grade. **More than two unexcused absences will lower your grade by at least one letter.** The greater the number of absences, the greater the reduction. Excused absences require documentation such as a letter from a dean. It is impolite to arrive late to class or leave the classroom while class is in session unless it is an emergency. **Habitual tardiness will lower your grade.** On the other hand, if you have perfect attendance in the course and no latenesses, I will add three points to your lowest exam.

Disclaimer

The above exam dates, quantity of graded work, policies, and course layout are subject to change in the event of extenuating circumstances.

The Center for Teaching and Learning (CTL)

At Hobart and William Smith Colleges, we encourage students to seek the academic collaboration and resources that will enable them to do their best work. The CTL offers a variety of resources that can help students achieve academic success, including Teaching Fellows (for course content help in some departments), Writing Colleagues (for help on papers), Study Mentors (for help with study skills and time management), Group Study Tables (for content help in specific courses), and more. For more information on these resources, visit the CTL webpage at <http://www.hws.edu/academics/ctl/index.aspx>, or visit the CTL Blackboard site.

If you are a student with a disability for which you may need accommodations, you should self-identify and register for services with the Coordinator of Disability Services at the Center for Teaching and Learning (CTL), and provide documentation of your disability. Disability related accommodations and services will not be provided until the registration and documentation process is complete. The guidelines for documenting disabilities can be found at the following website: <http://www.hws.edu/disabilities>. Please direct questions about this process or Disability Services at HWS to David Silver, Coordinator of Disability Services, at silver@hws.edu or x3351.

Academic Integrity

I highly encourage you to form a small group with whom you can discuss some of the journal work and collaborative assignments. Verbalizing your questions, explaining your mathematical ideas and listening to others will increase your understanding. However, you should **not** feel free to copy someone else's work or make your work available to someone else. **Copying constitutes plagiarism, a violation of academic integrity which could result in failure in the course. There is, of course, no collaboration or use of outside resources (including other textbooks and the internet) allowed on individual assignments, quizzes, in-class or take-home exams.** Violation of the Colleges' Principle of Academic Integrity will likely result in a report sent to your file in the dean's office and/or appearance before the Committee on Standards.

How to Succeed

- Attend all classes on time.
- Remain seated and attentive during all lectures, presentations and whole class discussions.
- Begin working on reading assignments as soon as they are assigned.
- Complete all exercises and examples within reading assignments.
- Spend some time **each day** working on the material from this class by yourself.
- Be prepared to present at least one proof and/or exercise solution every class.
- Participate in class discussions.
- Find one to three classmates with whom you can discuss the material outside of class.
- Ask your classmates and me lots of questions.
- Listen carefully to other students' ideas.
- Use my office hours liberally.
- Have fun!

First Collected Homework

This assignment will contribute toward your active participation grade. Write a full one page typed (usual font size and margin widths) autobiography. Are you planning on being a mathematics major or minor? Why did you choose to take this course? Share your favorite mathematical memory, your least favorite mathematical memory, your favorite mathematical topic, your favorite hobbies, and anything else interesting about yourself. The paper is due on Friday, January 21st at 3PM in my office, when you will sign up for a short meeting with me in my office. Please bring a photo of yourself with which you are willing to part to the meeting. This meeting and the photo help me get to know each of you better and more quickly. Your grade will be based on whether you address all topics requested, as well as the quality of your writing and your prompt attendance of our meeting, photo in hand. This assignment is worth fifteen points.