Instructor. Prof. J. H. Shapiro  
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(for online information about the class).  
*Office Hours:* M 10:20–11:10 AM,  
WF 12:40–1:30 PM, & by appointment


Prerequisites. MTH 234 or MTH 254H or LBS 220.

Course Objectives. We’ll cover most of Chapters 1–6 of the text, and perhaps some additional topics if time permits. The idea is to obtain a deep understanding of the theory that underlies the calculus you have already studied, and in the process, to learn how to do rigorous mathematics. For more details see the Comments on the back of this page.

Workload. To do well in this course you should expect to average six to nine hours of study per week outside of class (2–3 hours for each scheduled class hour).

Grades.  
*Preliminary grade.* This will depend solely on examinations, quizzes, and homework: 700 total points, apportioned as follows.  
Exam 1: Fri. Feb. 3 (100 pts)  
Exam 2: Fri. Feb. 24 (100 pts)  
Exam 3: Fri. April 7 (100 pts)  
Final Exam: Fri. May 5, 10am–Noon (200 pts)  
Homework: (200+ pts, see below for details).  

No exams, quizzes, or homework sets will be dropped.

*Final Grade:* In most cases your preliminary grade will be your final grade. However, other factors, such as: exceptional effort, positive contributions to the classroom experience, improvement over time . . . , can play a role in raising your preliminary grade, whereas negative factors such as lack of effort, declining performance, or disruptive behavior can lower it. Repeated disruptive classroom behavior can lead to failure in the course or dismissal from the class.

Grades of I. To qualify for an I a student must: (a) have completed 12 weeks of the term, but be unable to complete the class because of illness or other compelling reason, and (b) have done satisfactory work in the course, and in the instructor’s judgment, be able to complete the course without repeating it.

Homework. This will be the most important part of your learning experience in this course! I’ll assign and collect homework on a regular basis. Solutions must be written up in accordance with the Guidelines printed on the back of this page.

You may work with others on the homework problems if you wish, but you must acknowledge their contributions. Your final writeup must be your own. Flagrant copying will be penalized. Cases of cheating on either homework or exams will be handled according to the University’s policy on Integrity of Scholarship and Grades.

Policy on Makeup Work. The only valid reasons for missing an exam or a homework assignment are: (1) illness, or (2) a conflicting University activity that cannot be rescheduled. Claims involving such contingencies must be supported by verifiable documentation signed by: (1) your physician in case of illness, or (2) your faculty supervisor in case of a non-rescheduleable University activity. Each case will be handled on an individual basis.

Important dates.  
- Mon. 1/9: Spring semester classes begin.  
- Mon. 1/16: Martin Luther King Day—no classes.  
- Fri. 1/20: Last day to add course or change section  
- Fri. 2/3: End of Tuition Refund  
- Wed. 3/1: Middle of Semester  
- M–F. 3/6–3/10: Spring Break  
- Fri. 4/28: Last Class Day  
- Fri. 5/5: Math 320-1 Final Exam
Comments on this course. Together with Math 310, this course forms “basic training” for mathematics majors. These intermediate level courses serve as bridges from the basic mathematics you have seen in high school and in calculus to the more advanced mathematics courses you will take later. One of the major goals of Math 310–320 is to build your skill in understanding mathematical theorems and developing and writing their proofs.

Many Mathematics majors find these courses to be among the most challenging they take because the way of thinking may seem at first unfamiliar:

- Computation will not be the focus; most problems will not have a number or formula as an answer.
- You can’t master this material by memorizing rote procedures.
- Plausible reasons for expecting something is true, while to be desired, will not usually suffice. Proof will ultimately be required.

We will learn to understand mathematical theorems by:

- Analyzing important examples to determine why the theorem should be true, and then
- Developing the complete logical argument that establishes the truth of the theorem, starting from a clearly stated set of assumptions and using results established previously.

To succeed in this course you will have to train yourself to think about the logical structure of the subject matter and understand the definitions of concepts and the statements and proofs of theorems. You will need to understand a collection of key examples and be able to reason about their properties. You will need to document much more of your thinking about problems than you probably have done before. While a good intuition is necessary to guide you to correct statements, just making correct statements alone will not be enough. You must be able to prove them.

Why do you have to master this way of thinking in order to continue in mathematics? The answer is that this "abstract" proof-oriented work is the way all mathematics is communicated. On a deeper level, it is what mathematics—both pure and applied—is really about. The distinctive feature of our branch of knowledge, the concept of mathematical proof, is one of the crowning achievements of the human intellect.

Lest this sound daunting, be aware that you will have lots of chances to develop and practice these new skills, and I will always be willing to help you over the rough spots. Moreover, you will find our textbook to be an excellent resource, especially for the motivation behind the topics we study. Even if you find this course difficult at first, persistence and openness to a different way of thinking should eventually pay off.

Homework Guidelines

- Write up the problems in order, and neatly, using only one side of the page and leaving lots of space for me to write comments. Staple your sheets together.
- Begin each problem with a statement of that problem.
- Proofs should be written in complete sentences, with appropriate use made of mathematical notation (your textbook will serve as a guide to how to do this). Proofread what you’ve done to be sure that it’s complete and makes sense. Work on making your arguments clear and concise. Make appropriate use of notation and diagrams.
- If you leave a small gap in a proof that you’re not able to fill in, note this down. I’ll try to indicate how to fill it in my comments.
- Start early!
- If you work with others, you must write up your final solutions independently. Add a note to your solution listing the other people you consulted.

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1 Adapted from John B. Little, Holy Cross University.