

# ADVANCED CALCULUS, MTH 311

## GENERAL COMMENTS AND HOMEWORK GUIDELINES

This course, together with MTH344, is a stepping stone into higher mathematics. They both require a level of abstract reasoning much deeper than what you have probably experienced in your high school Mathematics classes and in Calculus. Many Mathematics majors find these courses quite challenging because of the new level of mathematical rigor demanded. Some distinctive features of the course include:

- The focus is not on computation. Most problems do not have a number or a formula as an answer.
- The emphasis is on precise writing of mathematical proofs and justifications. Offering plausible reasons for a result to be true is generally not sufficient. A proof is required.

We will take a two-step approach to understanding mathematical theorems.

1. We will discuss relevant examples to determine why the theorem *should* be true.
2. Then we will proceed to develop the precise logical steps required to arrive at the conclusion starting from the stated assumptions and using earlier results already proven.

While the first step is useful in guiding our thoughts it is the second step that guarantees that the result is valid.

In order to succeed in this course you will need to understand the precise definition of concepts and the statements and proofs of theorems. You will need to be able to produce examples and counterexamples that help illustrate concepts and results and determine the boundaries of validity of the theorems.

Mastering the way of thinking in this class is crucial for continuing into your mathematical studies. A mathematical proof is how Mathematicians *know* that a result is true. While you will learn about many results because a professor, or a book, or an internet site says they are true, ultimately you will only *know* they are true because you can prove them. More than any particular mathematical technique that found widespread application, it is, perhaps, the concept of mathematical proof that is the greatest contribution of mathematics to the advancement of human thought.

We will learn how to develop these *proving* skills through many examples, theorems, exercises, and class discussions. The textbook offers many excellent practice problems where you are progressively asked to fill in more and more details of the logical arguments. Work through them and you will master these techniques quickly.

Come to class every day. Use the class time to ask questions and discuss ideas. The most important interactions in class are generally not written on the board. Each student will take different notes and may remember the discussions differently, so somebody else's notes may be missing the comments that would have been more relevant to you.

Finally, you should READ THE BOOK! The text was chosen for its readability and careful organization of exercises and problems. It is ideal for addressing one of the most difficult questions students face: how do I get started? In particular, read the first page of the Preface where the author explains some of the features of the book.

## Homework Guidelines

The homework assignment is a more important part to your success in this class than what its proportion of the final grade suggests. Not only do the exams rely on homework problems as well,

but it is only when attempting problems on your own that you truly grasp the concept of proof and what it entails. When working on the assignment, please follow the guidelines below:

- Write up the problems in order and neatly. You may use both sides of a page but you must leave enough room between problems and between lines for me to make comments. This is the most important feedback that you will receive from me, because it will address your individual difficulties. *Staple the pages together on the upper left corner.* Write your name clearly on the front page.
- Proofs should be written in complete sentences and using appropriate mathematical notation. Use your textbook as a guide: look at examples and proofs of theorems. Proofread what you wrote to make sure it makes sense. DO NOT invent your own notation when a standard one exists, nor use a standard notation for a different purpose. If you must introduce new notation (and sometimes it is good to do so) make sure you clearly indicate what a symbol stands for.
- Start early. You will generally have several days to complete each assignment. If you get stuck ask me in class, office hours, or via email. I may be able to give you a hint or clarify an issue and get you on your way.
- While you are allowed, and even encouraged, to discuss *general issues* with your classmates your final solutions must be individual work. If you are not sure about where to draw the line ask me. If you consult other people list them in your write-up. The best way to work in groups is to look for a similar problem in the text and work on *that problem* together, leaving the actual problem in the homework assignment to be done later individually.

IMPORTANT NOTE: Homework assignments are due at the beginning of class on the date indicated. Late homework will get half credit if turned in by the following day and no credit after that.