# MATHEMATICS 311: COMPLEX ANALYSIS

**Class**: MTWF 12:00–12:50 in P240

**Instructor**: Jerry Shurman

**Office**: L386, extension 7351, email `jerry@reed.edu`

**Hours**: Please see my schedule, online or posted outside my door

**Text**: Marsden and Hoffman, *Basic Complex Analysis*, third edition (Freeman). This book is modern and friendly, with lots of pictures, worked examples, motivation. The lectures will follow the basic outline of the text for the first half of the course. After that we get to choose from a range of topics. With the basics under control you can make informed choices that reflect your tastes.

There are many fine books on this subject. *Visual Complex Analysis* by Tristan Needham has a good reputation, but I haven't read it closely. Steve Krantz, who has a good reputation, has a complex analysis book. The slim volumes by Knopp (available from Dover) manage to say a lot in very little space, and yet without being dense either. Complex analysis can be treated from various more advanced perspectives as well. See for example, *Complex Analysis: A Functional Analysis Approach* by Leucking and Rubel. Most of these books, and many others, are on library reserve for this course. Also, a tentative lecture schedule, a homework schedule, and various materials related to the lectures are posted at my home page.

**Homework**: Assignments will be given weekly. Feel free to work together, provided that what you turn in is truly your own. These contradictory-sounding notions are—within limits—up to you to interpret; a reasonable model might be brainstorming with a group and writing down some rough ideas in scratch form, and then going off somewhere to do your write-up. The point is to *learn*, and neither sitting alone with no inspiration nor copying a classmate's solution off the board will facilitate this. If some problem is point-blank too hard, it's better to write up a coherent verbal description of what you understand than some garbled calculations that you don't.

**Exams**: An hour quiz in class after a few weeks, then a take-home midterm and a take-home final.

Classical complex analysis is a blend of mathematics as a realm of ideas and as a collection of problem-solving tools. The theory of analytic functions of one complex variable is clean and elegant, and it answers many practical questions on the line and in the plane. It is an area of mathematics that yields surprising results for comparatively little effort. I hope to convey some of my enthusiasm for the subject to you.

I will try to make my teaching clear, direct, simple and cheerful, and in return I assume that you are here because you want to be. Since this is an upper division class I expect a certain amount of mathematical maturity from my students—not necessarily quickness or background, but interest, curiosity, and above all, willingness to work and learn. If you have trouble with the material, struggle with it a while before seeking clarification. The best way to learn is actively. What you

figure out for yourself will be far more vivid than anything I explain. On the other hand, though my standards will be high and I will not back off from them, I will do all I can to help you.

I welcome all feedback. Please don't feel shy or afraid to talk to me.

During lecture, try to stay involved with what's going on and not just watch the formulas on the board. Taking detailed notes is not as important as listening to absorb as much as you can of what's being done and to what purpose. After lecture you may want to review your notes and pad them out when we aren't working from the book. Best of all, skim (don't read in detail) each section of the text before the lecture on it; then you can follow the main themes in the lecture much more readily; and finally it is easy to read the section thoroughly after the lecture since you'll have a good grasp of its essentials. When we depart from our text later in the term, I'll try to provide appropriate readings for those who want them.

This technique for reading mathematics—skim first, then go back to consolidate—is extremely valuable. The alternative is to get bogged down in details until you lose the flow of the argument and no longer see why things are happening. A good way to check your understanding is to try summing things up periodically in a sentence or two, e.g., we used method $X$ to prove theorem $Y$ that describes object $Z$ in terms $W$. If you get stuck on some step or detail, don't stop there. Skip it and move on. One last tip for math reading: it's much easier to do with pen and paper at hand—writing out steps you're unsure of is less draining than doing them in your head, so you won't tire of concentrating as quickly.

Though stopping my office randomly is not guaranteed to find me, you're welcome at my office during the listed hours and especially by appointment. I would enjoy seeing you and helping you if you need it.

This course will cover a lot of ground and move quickly, so stay caught up. Math is fun when you're on top of it. Which brings me to my most important point: enjoy the course.