Calculus is a powerful mathematical tool which has proven to be of profound practical use in the sciences and one of the great achievements of human thought.

But you know that already.

The theory of calculus with complex numbers, also known as the theory of functions of a complex variable, is significantly richer than just the extension of calculus to the real plane. The beautiful underlying algebraic and geometric structure of the complex numbers allows us to describe a large class of extremely well-behaved and physically-relevant functions with a very small number of conditions and allows us to better understand functions of a real variable. It’s an exciting twist on a well-known story, and will quite possibly answer many questions you never knew you had.

This course is an introduction to complex analysis, intended for students of mathematics, physics, and engineering. We will focus on a careful development of the theory as well as some applications to physical problems, often concerning harmonic functions. Proofs will be written, problems will be solved, memories will be made.


Course Materials: You will be able to find a syllabus, course outline, homework assignments, announcements and so forth on my course webpage listed above. You should check the website regularly for updates and changes. You should be able to keep track of your grades on Moodle.

Grading: Grading Your grade is based on
- Homework: 30%
- Midterm Exam: 30%
- Final Exam: 40%

Homework: There will be twelve homework assignments and uncollected practice problems from the textbook. Homework will be assigned every week on the course website and will be collected on Thursday (unless otherwise stated) by the end of class. If you expect that you will be absent from class, you must either get a hard copy of the assignment to me before class or have a friend hand it in for you. No late homework will be accepted, no excuses. As a release-valve for unexpected disaster striking (e.g. illness, family emergency, just a really busy
week) the lowest two homework grades will be dropped. You are still responsible for all of the material covered in all of the homework assignments, even if you don’t hand them in.

None of you are new to math, so it probably goes without saying that homework problems will often be harder than the examples given in lecture, this is because much of the purpose of homework is to practice using more basic techniques to break down larger, multifaceted problems. Note that you are not done with a problem just because you got the right answer, but when you understand why the methods you used had to have worked. The problems should make sense to you. **Show your work.** Give clear and thoughtful answers when explanation is required. Remember, the homework you hand in is worth 30% of your grade, but the homework you understand is worth the other 70%.

**Academic Integrity and Collaboration:** You are expected to abide by all Queen’s University academic integrity standards. All exams and quizzes will be closed-book without the help of gadgets or accomplices. However, outside of test environments, your peers are a valuable resource, and I encourage you to seek each other out. There is a strong qualitative difference, however, between working together to share ideas (which is good) and copying one another (which is bad). Your solution write-ups should be your own and in your own words, and you should be able to arrive at your answers independently.

**Technology:** While computers, tablets, phones, etc. are valuable sources of information, there is little cause to use them during lecture. They are permitted if you use them for note-taking, but otherwise please refrain from using them for activities unrelated to the class.

You are expected to do exams without the aid of electricity.

**Submitting Homework:** The following rules will be strictly enforced:

1. Write your name clearly at the top of every page.
2. Do not put different problems on the same piece of paper (each assignment will have about 4-5 problems so this shouldn’t be a major ecological hardship). This is because I may split the problems up among graders for grading.
3. Clearly number each problem. If a solution spans multiple pages, indicate the problem number on each page as well as the page number.
4. **Staple** your homework. Paperclips and folded corners are accursed and unacceptable.
5. Turn in assignments on time. Late homework won’t generally be accepted.
6. Write neatly. If your homework is too messy to read, it will not be graded.

Requests for homework extensions will be denied.

Again, if you are absent from class on a day homework is due, please make arrangements to get the assignment to me beforehand, or get a friend to hand it in for you.

**Exams:** There will be one midterm on October 30th, from 6:30-8:30 PM in Stirling Hall A. There will also be a final exam, with the time and schedule TBD sometime during the December exam period. Exams are closed-book and without notes. Unexpected absences will not be permitted except for a severe medical problem or dire emergency. A written note from an appropriate authority (doctor, dean, etc.) is required. If you expect to be absent on an exam day, you need to make arrangements well in advance (usually more than a week).

Exam problems will be modeled after homework problems, so the best way to prepare is to do and review your homework. Once again, and I cannot emphasize this enough, **show your work.** Especially in test environments. Full credit is given to people who give complete answers and partial credit is given to people who can make significant progress toward a problem.

**Questions:** Mathematical questions are encouraged at any time during the class. Don’t be
afraid to ask them. I am also available for general and specific questions via e-mail and during office hours.

**Office Hours and Appointments:** For those of you unfamiliar with the concept, my office hours are times where you can drop by without an appointment and ask me questions about the material, homework, etc. You can also drop by if you don’t have any questions but you want to listen in on other student’s questions. I am also available by appointment, and if you want to meet with me outside of my office hours, e-mail me your schedule and we’ll set up a time.

**Learning Differences and Disabilities:** If you have a documented learning difference that needs to be accommodated, regarding the exams or otherwise, you should let me know about it as early as possible and provide a note from the requisite authorities on the matter. Furthermore, Queen’s is committed to providing support for students with physical impairments, and other disabilities. If you think you may need accommodations due to one of these conditions, contact [Queen’s University Disability Services](#) for more information.

**How To Succeed:** If you aren’t able to attend class regularly and fail to do the homework, you’ll probably fall behind. Material in this class is cumulative, it builds on itself, and if you miss something without making an effort to catch up, odds are good that it will haunt you until final exam day. You should come to every class. If you’re having difficulty, please let me know. Ask questions in class, attend my office hours, seek each other out outside of class.

**Math Help Center:** There’s a Math Help Center in Jeffery 201, open from 9:30am to 6:30pm. The tutors there can help answer your questions, although you might have to look at the chart to make sure there is someone on duty who understands complex analysis. It may also be a good place for you to seek each other out.

**Outline:** The following is a general outline for the material covered throughout the course and is subject to mild variation.
- Complex numbers, their arithmetic, and the complex exponential.
- Möbius Maps, the Riemann Sphere and Stereographic Projection
- Analytic functions, Cauchy-Riemann equations, harmonic functions.
- Integrals, the theorems and formulas of Cauchy, applications.
- Series representations, Taylor and Laurent series.
- Zeros and poles, residues.
- Applications of residues to the calculation of definite integrals.
- Conformal mappings.

**The Letter Zed:** The standard variable in complex analysis is the letter $z$ which, since I am a US Citizen, I am predisposed to pronouncing “zee”. As I am a stranger in a strange land, I will make a concerted effort to respect that I am north of the mighty St. Lawrence River and try to say “zed” consistently. I will fail. You may freely correct me until I ask you to stop.

If there any other questions about the course, please feel free to contact me via the e-mail address given at the top of this document. I look forward to seeing you all this summer.

Cheers, Tom