

## Course Staff

### Instructor:

Name	Section	E-mail	Office Hours	Room
Thad Janisse	LEC 5101	thad.janisse@mail.utoronto.ca	TBA	BA 6283

### Teaching Assistants:

Name	E-mail	Office Hours	Room
Belal Abuelnasr	belal.abuelnasr@mail.utoronto.ca	TBA	
Shuyang Shen	shuyang.shen@mail.utoronto.ca	TBA	
Ivan Telpukhovskiy	ivantelp@math.utoronto.ca	TBA	

## Course Description

The complex numbers differ from the real numbers rather dramatically. The addition of solutions to the equation  $x^2 + 1 = 0$  to the real numbers seems like a small thing, but ends up having far reaching consequences.

To begin, we'll introduce the complex numbers and various techniques for manipulating them algebraically. This will not differ very much from working over  $\mathbb{R}$ , except for the addition of a "polar form" for complex numbers.

We'll swiftly move to studying functions of complex variables. We'll see that all polynomials have roots, that all differentiable functions are differentiable infinitely often (subject to an easy condition), and that's just a few ways in which complex functions are much nicer than real functions.

We're going to look at: complex algebra, polynomials over  $\mathbb{C}$ , the topology of  $\mathbb{C}$ , functions and limits, sequences and series, exponents and logarithms, differentiation and holomorphic functions, the Cauchy-Riemann equations, power series and analytic functions, line integrals, Cauchy's integral Theorem and formula, singularities and the Residue theory, meromorphic functions, and contour integration.

Time permitting, we will also talk about the argument principle and max modulus principle, conformal mappings, and harmonic functions in depth.

**Textbook.** *Complex Variables, Second Edition*, by Fisher.

We will be following the book, more or less. There are some topics that I might do a bit out of order, but I will say as much.

**Course Website.** We will still be using blackboard this semester. Make sure to check regularly, as I will be posting materials, such as suggested problems, throughout the semester.

**Office Hours.** Please do not be hesitant to come ask us for help. The staff of MAT334 are available for extra help outside of class, during our scheduled office hours (see above for dates/times).

In addition to these hours, before tests and exams we will hold extra office hours. The times and locations of these hours will be posted on the course webpage. If you cannot make any of the scheduled office hours, please let the instructor know, and hopefully an alternate meeting can be arranged.

**Tutorials.** Tutorials will begin May 15. All students must be enrolled in a tutorial section (on ROSI/ACORN). You should only attend the tutorial you are enrolled in. The main purpose of the tutorial is to give you an opportunity to ask questions and work through examples together with your TA. To get the most from your tutorial, you should review the lecture material and try the assigned problems *before* your tutorial, so that you come prepared with questions.

## Marking Scheme

Your final grade will be determined as follows:

Quizzes (Best 4 out of 5)	20%
Two Midterms:	
Lower Midterm	15%
Higher Midterm	25%
Final Exam	40%
<b>Course Grade</b>	<b>100%</b>

In the event that you miss **one** midterm for an approved reason, your marking scheme will be:

Quizzes (Best 4 out of 5)	20%
Midterm	30%
Final Exam	50%
<b>Course Grade</b>	<b>100%</b>

## Midterms

We will have two midterms. The date for the first is **TBA** (I am waiting to hear back from the department regarding scheduling this). The second will be held on **Thursday, July 26 during class**

**time.** We will not be using our lecture room to hold the midterms. More information regarding material covered and location will be posted to the course website closer to the date of the test.

## Quizzes

We will be holding **quizzes in tutorial**, according to the course schedule. Each quiz will last approximately 20 minutes. You must write the quiz in your own tutorial section. **Quizzes written in the wrong tutorial section, without prior approval from myself or the TA, will not be marked and will be recorded as a mark of 0.**

## Final Exam

The final exam of the course will take place during the examination period in August, and will be 3 hours long. It will cover all the material presented in lectures (unless explicitly announced otherwise on Blackboard). The date, time, and location of the exam will be arranged by the Faculty of Arts and Science, and posted once it has been set.

The final exam period is August 16th - 22nd. You should take this into account when planning any travel for the end of the semester. In particular, the Faculty will set the exam date whenever they please, so make sure you're available to write the final!

## Missed Work

I understand that sometimes life gives you lemons, and for a variety of reasons you may not be able to write one or more evaluation.

**Illness.** If you miss the midterm or a quiz due to sudden illness, please inform me **as soon as possible**. You will be assigned a grade of 0 for any midterm exam or quiz that you do not write unless you submit a University of Toronto Verification of Student Illness or Injury form within **one week after the date of the missed assessment**. This must be the **original physical copy**. I also encourage you to email me a scan as soon as you can, but this will not suffice as a substitute for the physical form.

The form must have all the required fields properly filled out and it must list the doctors OHIP number. The form must clearly state that on the date of the exam you were unable to write. Accordingly, it's expected that you will have met your doctor on the date of the exam. Illness before the exam is not sufficient grounds for not writing the exam nor is the claim that you would have performed sub-optimally. The form cannot just report that you told the doctor after-the-fact that you were

ill previously. The form must be original and completed by a qualified medical doctor - not an acupuncturist, chiropractor, or other health care professional.

Once you submit your form, it will be reviewed before it will be accepted. Part of the review process may include following up with your doctor, your college registrar, or the undergraduate chair of the math department. It is an academic offence to feign illness to miss an exam.

If you do miss the Midterm for a legitimate reason that you can document, and your documentation is accepted, then we will work out alternative arrangements.

**Other Reasons.** If you know in advance that you are going to miss an evaluation, let me know **immediately** so we can make alternate arrangements. Except for sudden and extreme circumstances (eg. death of a family member), I require that you provide at least **one week** of notice prior to the evaluation. You must also supply me with any supporting documents I might need to make a determination (eg. obituary, etc.) While I will make every effort to be understanding of your situation, I reserve the right to deny unreasonable requests (for example, vacations booked after the first day of class).

**Alternate arrangements.** Alternate arrangements in this case may include shifting the weight of the assessment to the final, or writing a rewrite (if at all possible) in the event of a missed midterm. Such determinations will be made on a case by case basis.

In the event of a missed quiz for a documented reason, we will not be offering rewrites. In this case, we will simply reduce the total number of quizzes considered in the calculation of your grade. For example, one missed quiz due to illness will result in your quiz grade being calculated as best 3 out of 4. In addition, we will also shift the weight of that missed quiz to the final exam. So, a single missed quiz (for a valid reason) will result in your quizzes being worth 15% of your final grade and your final exam being worth 45%.

## Help

If you need help there are many resources available to you. Please come and ask us for help as soon as you need it. Try not to fall behind. I will have office hours, which are posted on the course page, and at the top of this handout. You will have opportunities to ask questions in Tutorials. The Math department runs a Math Aid Centre (PGB 101), which is staffed by TA's for "drop-in" math help. If I find any useful resources on the internet (such as video tutorials, problem banks, etc.), I will share them on the course Blackboard.

**Email.** Feel free to contact me by email if you have any questions about the course. I try to respond within 48 hours. That said, there are a couple of ground rules you should observe:

- Any emails related to this course must have MAT334 in the subject line.
- I will only correspond via utoronto email addresses. As such, if you send an email from your gmail account, or other email provider, I will not respond.
- If your question can easily be answered by referring to the syllabus, or to an announcement on blackboard, I will probably not respond.
- As in all things, be respectful.

If you need to arrange something with me, such as an appointment if you can't make my office hours, please do so via email.

## Accessibility Services

The university strives to foster an inclusive and accessible atmosphere. Should you need accommodations due to an accessibility issue, please do not hesitate to contact accessibility services. Their webpage contains all the information you need to contact them.

## Code of Behaviour / Plagiarism

Students should become familiar with, and are expected to adhere to, the Code of Behaviour on Academic Matters which can be found in the U of T Calendar, or at:

<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>

**More links concerning academic integrity to familiarize yourself with:**

<http://www.artsci.utoronto.ca/osai> (Office of Student Academic Integrity)

<http://www.utoronto.ca/academicintegrity/> (Academic Honesty)

<http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize>  
(Advice on avoiding plagiarism)

<http://www.artsci.utoronto.ca/current/exams/reminder>

## Practice Problems

I will be suggesting problems from the textbook, as well as posting some extra problems.

It is important that you attempt these problems. One does not learn math by sitting in a lecture hall and taking notes, but rather by sitting down with pencil and paper and practicing until it falls into place. However, to incentivize you to attempt these problems, I will be taking quiz and test problems from the practice problems.

## Course Outline

The following is a rough outline of the material which will be covered.

Date	Fisher	Topics	Info
May 7 - 11	1.1	Complex Plane, Modulus and Argument, Conjugation, Vectors, Polar Form, Complex exponential, de Moivre's Theorem, $n^{th}$ roots of Unity	
May 14 - 18	1.2-1.5	Topology, functions of complex variables	Tutorials start
May 21 - 25	1.6, 2.1 - 2.4	Logarithms, Branches, Complex Powers	Quiz 1
May 28 - June 1	1.6, 2.1 - 2.4	Cauchy Riemann equations, harmonic functions, conjugates, analyticity and continuity.	
June 4-8	1.6, 2.1, 2.3 - 2.4	Review of line integrals and Green's theorem, algebra of curves, estimation of integrals, antiderivatives.	Quiz 2
June 11 - 15	1.6, 2.3 - 2.4	Contour integrals, Cauchy Theorem, deformation theorem.	Quiz 3
July 3 - 6	1.6, 2.3 - 2.4	Cauchy integral formula and some important consequences.	
July 9 - 13	2.2, 2.5, 2.6	Power series, Taylor series, Laurent series.	Quiz 4
July 16 - 20	2.2, 2.5, 2.6	Zeros and singularities, multiplication and division of series, analytic continuation.	
July 23 - 27	2.5, 2.6	Residue theory, residue theorem, evaluation of real integrals.	Midterm 2
July 30 - Aug 3		Catchup or more fun topics!	
Aug 6 - 10		Review.	Quiz 5