Math 4200: Introduction to Complex Variables

University of Utah – Fall 2020

Course Section: Math 4200-001
Meetings: Monday, Wednesday, Friday 11:50 AM – 12:40 PM, Online Synchronous

Instructor: Nick Korevaar
E-mail: korevaar@math.utah.edu
Phone: 801-581-7318 (I will rarely be in my office this semester so better to e-mail)
Office: LCB 204
Office Hours: 1:00 - 2:00 PM Monday or Wednesday, or by appointment. On ZOOM
Homepage: Online via Canvas. Official announcements and homework assignments
will be posted there. Check in on Canvas at least twice per week for announcements
and updates.

Text: Basic Complex Analysis, third edition by Jerrold E. Marsden and Michael J. Hoffman (required)
Prerequisites: Math 3210-3220 or equivalent; we will use concepts from analysis
including estimation via the triangle inequality; continuity; the derivative matrix and
differentiability of multivariable functions; path integrals and Green’s Theorem. Section
1.4 of the text contains a review of many but not all of these topics, as they will be
applied in our context. You will be expected to learn and to be able to explain the key
theorems in this course and your homework will include theoretical problems along with
computations and applications.

Course description and learning outcomes: This is material from Chapters
1-5 of the text. We may cover additional material if time permits and via student
projects.

1) Complex number algebra and geometry: addition, multiplication, conjugation,
inverse, Euler's formula, the polar form of complex numbers in the complex plane.
2) Complex differentiability and rotation-dilation differential map for transformations of
the complex plane. Connection to harmonic functions.
3) Conformal transformations between open connected subsets of the complex plan,
branch points and branch cuts, complex exponential and logarithm, powers, fractional
linear transformations, Riemann mapping theorem.
4) Contour integrals, Cauchy’s Theorem and Cauchy’s Integral Formula. Homotopies
and antiderivatives in simply connected domains.
5) Power series and Laurent series for analytic functions, classification of isolated
singularities, Liouville’s Theorem and the Fundamental Theorem of Algebra.
6) Residue Theorem and applications.
Format
This class is listed as an IVC course in the university catalog, which stands for Interactive Video Conferencing. This means that the class will be delivered “synchronously”, i.e. live and at the time listed but entirely online.

We will meet via the Zoom video conferencing software. If you don’t have Zoom you can download it for free from zoom.us/download. It is strongly suggested that you have a webcam and microphone to fully participate in the class but you should not need anything else. It is also possible to dial in to hear the audio with just a phone.

The Zoom meeting details can be found on the Canvas page or by e-mailing the instructor.

My intent is to make this a “semi-flipped” classroom. I plan to produce lecture videos for you to watch before the class, and then during the class time itself I will answer questions about the videos or add more context. I hope to make the class time as interactive as possible and so I encourage your questions during that time. I will also be happy to go over your homework problems (see more about homework below) and do more worked examples. I plan to have group quizzes on Wednesdays, for the last portion of class, where I split everyone into groups via the breakout rooms feature.

During class time I ask that everyone keep their microphones muted so as to eliminate background noise. You may also turn off your video if you so desire. If you would like to ask a question feel free to unmute yourself and interrupt me. If you are speaking please do turn on your video, if possible. It’s also helpful if you identify yourself verbally so that I know who is speaking.

Classes will be recorded and made available on Canvas, so if you need to miss a lecture you can always watch it later. Class recordings will not be made available to the general public and will be deleted at the end of the semester, but be aware that a recording will exist for a few months. Because of this, please refrain from giving out any sensitive personal information during class time, such as grade information, ID numbers, housing details, etc.

Attendance
There are only three dates that you are required to attend class: the dates of the first and second midterms: Fridays October 9 and November 13, and the final exam: Monday December 7, 10:30-12:30. Since the Wednesday quizzes are small part of your course grade it would also be wise to not miss those. I encourage you to attend all classes and to be an active participant.
Technical Requirements
To attend the live version of the class you need a computer with the Zoom software and a relatively strong internet connection. A microphone and camera are strongly recommended for class attendance but not strictly required.

You will, however, need a microphone and camera for taking the midterms and the final exam. Exams will be monitored on Zoom, at the regular class time and the announced final exam time. I will ask you to turn on your camera and I will monitor the exam. This will also give you the opportunity to ask questions about the exam. If this arrangement will be impossible for you please let me know as soon as possible.

You will also need to access Canvas regularly to receive class announcements, access the videos, and obtain homework. You will also submit your homework, quizzes and exams online via Canvas, using Gradescope.

If you have a tablet or a similar computerized writing surface, the simplest method is usually to download the exam or homework pdf, write directly on that, and then re-upload it to Canvas. Otherwise, if you have a printer you can print out the exam, write on that, and then scan and upload the write-up. If you do not have a printer you can simply write your solutions on a blank piece of paper, clearly indicating which problem you are solving. If you do not have a scanner there are many apps that convert your smartphone into a scanner. Please make sure you have an app that can convert the files into pdf format, as Gradescope requires this.

Grading
Homework: 30%, Midterms: 2 @ 15%, Quizzes: 10%, Final Exam or Project: 30%.
Typically letter grades are assigned as: A: 93%+, A-: 86%-92%, B+: 80%-85%, B-: 74% - 80%, C+: 68%-73%, C: 61%-67%, C-: 55%-60%, D: 50%-54%, E: < 50%

• Homework (30%): There will be one homework assignment each week, due on Wednesdays by the start of class. Homework assignments will be posted on CANVAS on the preceding Wednesday. I understand that sometimes homework cannot be completed on time due to circumstances beyond your control. To account for this, each student will be allowed to turn in two late homework assignments throughout the course of the semester. These assignments cannot be turned in more than one week late. You do not need to tell me the reason why your homework assignment is late. Homework will be a mixture of problems from the text and custom problems. I encourage you to work collaboratively on the homework assignments, but write up and hand in your own work.

• Quizzes (10%): At the end of most Wednesday classes, a short 1-2 problem quiz will be given, taking roughly 10 minutes to do. The quiz will cover relevant topics from the weeks lectures and homework. Your lowest two quiz scores will be dropped. There are no makeup quizzes, but your two lowest scores will be dropped. My plan is to use ZOOM breakout rooms for you to work on the
quizzes collaboratively.

- **Midterm exams (30%)**: Two class-length midterm exams will be given, on Friday October 9 and Friday November 13. I will schedule a ZOOM review on Thursday before each midterm, at our regular class time of 11:50-12:40, where I will go over a midterm from a previous iteration of this course. No midterm scores are dropped.

- **Final exam or project (30%)**: A two-hour comprehensive exam will be given at the end of the semester, Monday December 7, 10:30-12:30. As with the midterms, a practice final will be posted and we will have a review session. You may opt out of the final exam by completing a project, by yourself or with one or two other people, on some complex analysis application or topic. Each project shall consist of a 5-10 page expository paper, and a presentation to the class of at least 20 minutes in length, but possibly longer. These presentations will be during the last few lecture periods of our class. I will be available for pre-presentation consultation and practice. Project groups and topics must be approved by me, by **Friday November 6**. In the past, people have worked on topics such as hyperbolic geometry, Riemann surfaces, minimal surfaces, Julia sets, the prime number theorem, fluid mechanics, or other suitable topics in their areas of interest.

**Protocol for Taking Quizzes, Midterms, and Finals**

The online nature of this course presents unique challenges for the delivery, taking, and submission of timed exams. Dealing with this issue will require some flexibility and ingenuity on the part of all of us.

All exams will be administered through Canvas and Zoom. They will need to be accessed **during class times**, you will have a pre-defined time period during which to take them, and then you will need to re-upload your solutions at the end. I will try to give ample time for you to download and upload quizzes.

**Important Dates**

First class: Monday August 24  
Last day to add, drop, elect credit or no credit, or audit: Friday September 4  
Midterm 1: Friday October 9  
Last day to withdraw from classes: Friday October 16  
Midterm 2: Friday November 13  
Last class: Wednesday December 2nd  
Final Exam: Monday December 7
Communication
Class announcements will be done via email through the Canvas server. You will be responsible for any information contained in them as well as the information announced in class. Students should check Canvas regularly and set up notifications that are directly forwarded to their e-mail inbox. You should also regularly check your UMail or forward it to an address that you monitor regularly.

Disclaimer
We will see how the semi-flipped format works, and it will be a new experience for me. Based at least partly on your feedback I could potentially revert back to a more standard format, where I post note outlines and we work through those during class, without the pre-class videos. I taught this class last fall 2019, and you can see old lecture notes and course material for that format posted at http://www.math.utah.edu/~korevaar/4200fall19. More generally, I reserve the right to make changes to our course structure if the need arises. If this happens I will let you know in lecture and on CANVAS.

The Americans with Disabilities Act
The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Addressing Sexual Misconduct
Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS).

Campus Safety
The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu