

# Introduction to Mathematical Reasoning Syllabus

## 300:T6 Summer 2020

“The greats weren’t great because at birth they could paint. The greats were great because they paint a lot.” - Macklemore & Ryan Lewis

|                               |   |                     |
|-------------------------------|---|---------------------|
| <b>Instructor</b>             | <b>Email</b>  | <b>Office Hours</b> |
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| <b>Textbook</b>               | <b>Course Website</b>   | <b>Canvas Site</b>  |
| <a href="#">Book of Proof</a> | <a href="https://sites.math.rutgers.edu/~ceu11/Courses/300Summer2020.html">https://sites.math.rutgers.edu/~ceu11/Courses/300Summer2020.html</a> |                     |

“The first question is: Can learning take place if in fact it silences the voices of the people it is supposed to teach? And the answer is: Yes. People learn that they don’t count.”

--Henry Giroux, Border Crossings: Cultural Workers and the Politics of Education

It is my intent that students in this class have equal access, opportunity, and support, regardless of how the student identifies, presents, thinks, or communicates. Furthermore, I believe that everyone has a distinct way of thinking about a problem or concept. That variety of perspectives is an asset to our course, and I intend to take advantage of it. To help accomplish this, I make the following commitments.

- All people have the right to be addressed and referred to in accordance with their personal identity. In this class, we will have the chance to indicate the name that we prefer to be called and, if we choose, to identify pronouns with which we would like to be addressed. I will do my best to address and refer to all students accordingly and support classmates in doing so as well.
- If you feel that your performance in the class is being impacted by your experiences outside of class, please do not hesitate to come and talk with me. I want to be a resource for you. The Canvas page will also include a tool to submit anonymous feedback.
- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it. (Again, anonymous feedback is always an option).

Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

## Course Description

Fundamental abstract concepts common to all branches of mathematics. Special emphasis placed on ability to understand and construct rigorous proofs. Prerequisite: CALC2 or permission of department.

This course is specifically intended to help Mathematics majors prepare for 640:311, 640:350, 640:351 and other proof-oriented courses. It is required for any mathematics major who is not already experienced in doing mathematical proofs.

Students need to obtain a C or better in 640:300 in order to be eligible to take 640:311, 640:350, or 640:351

## Technology Requirement

All students in this class are required to have a camera and microphone. A webcam and mic built into a laptop is ideal, but a smartphone will also get the job done.

## Online Format

As with all other Rutgers courses in the summer of 2020, this course will run fully online. All class material, assignments, meetings, and announcements will be on our Canvas site.

Unlike many of the online courses you have experienced so far, this class will run **asynchronously**. Here is what that means for you in practice:

- There are no pre-scheduled live class meetings. All course content will be delivered to you as videos, readings, and activities on the Canvas site.
- You will still have deadlines for all of the assigned tasks, but you have some freedom to choose what days and times you work on those tasks (more details on these tasks below).
- You will still be engaging in dialog and discussion with me and your fellow classmates, just not necessarily in the format you are used to. There are many different modes of engagement built into the design of this class, and you can choose which ones work best for you (more details on that below).

## Grading Scheme

The grading scheme for this course is probably different from what you are used to, but it is designed to provide the flexibility necessary to best support all students during this chaotic time.

There are 3000 possible points you can earn in this class. These points are earned through a variety of tasks, which are detailed below. Your grade will be determined based on how many total points you earn over the course of the semester, with the following breakdown:

| LETTER GRADE | POINT RANGE    |
|--------------|----------------|
| A            | 2250 and above |
| B+           | 2100-2249      |
| B            | 1950-2099      |
| C+           | 1800-1949      |
| C            | 1650-1799      |
| D            | 1350-1649      |
| F            | 1349 and below |

Notice that you only need to earn 75% of the total available points to earn an A in this class. The reason is that you are not expected to complete every assignment. Indeed, completing every assignment would take much more time than I could reasonably expect from students. There are some assignments which I expect everyone to complete, but there are some others that you can pick and choose from. More on that below.

## Planning and Mid-Semester Check-in

- Because this is a different model from what you are used to, I want to help you plan for success. So, for the first two weeks, you are encouraged to try each of the types of activities. At the end of the second week, you will submit a plan for what grade you are shooting for, how many points you plan to attempt in order to reach that goal, and which assignments you plan to complete to add up to that number of points. This plan does not commit you to anything, but it will help you to get started strong and help me to advise you along the way (and you'll get some points just for completing the plan!).
- Halfway through the semester, you will also meet with me (virtually, of course) for a mid-semester check-in. We will talk about how your plan is going, and whether you need to adjust it in order to reach your goal by the end of the semester.

## Academic Integrity

Copying, collaborating, and getting help are all *very* different things. Understanding the distinctions is crucial for students in this and all other university classes.

*Copying* means taking work from the internet (including anything on Chegg, Varsity Tutors, and CourseHero), another student, or any other source at face value and submitting it as your own. Copying constitutes a violation of the academic integrity policy and will be reported to the proper Rutgers offices.

*Collaborating* means working with classmates on a problem assigned as group work, discussing homework problems with classmates, or studying for exams together. In this class you are encouraged to spend a lot of time working in groups. However, you will still receive your own grade for the course and will therefore need to do your own work. So, how do you know when the group work must stop, and the individual work begins?

Follow the “**Sauna Rule**”: If you work out problems with other students, do not copy the answers. Instead, go take a 30-minute sauna, and then write up the answer on your own without the aid of group work. Copying work that is not yours is plagiarism, even if the work was done as part of a group discussion of a problem.

*Getting help* from someone who is more familiar with the material than you are **may also constitute copying**. Of course, if you come to office hours or ask me (the instructor) questions, I know what level of help you've received and can structure the conversation to avoid the question of plagiarism. You may not, however, get help from anyone who is not the instructor or another student currently in the class. The only exception to this rule is the use of the tutors at the Rutgers Learning Centers. You are encouraged to use this recourse that is made available for free to all Rutgers students. Just make sure you still follow the Sauna Rule if you get help from a Rutgers Learning Center tutor.

## Internet Searches and Other Sources

Pay close attention to all instructions for the different assignment types. For most assignments, you may not search the internet for anything related to the questions or use any resources outside of those posted on the Canvas page. For most, you may use any notes you have or any resources posted to the Canvas page, but for some parts of exams, this is not the case. Every assignment will clearly outline what you may and may not use to complete it, so always read the directions carefully.

You are expected to make mistakes on your homework problems, and the grading policy is designed to compensate for that. I have plenty of office hours where you can ask questions. Searching the internet will often lead you to solutions which are misleading at best. I have posted a lot of resources which you may use, and of which I have confirmed the accuracy. I also have plenty of availability to meet in office hours if you have questions.

You may (and in fact are encouraged to) search the internet for anything about working in LaTeX. I will not in any way test you on memorization of LaTeX. Professional mathematicians routinely search the internet for help with typesetting, and it would therefore be unreasonable (and quite frankly, pointless) for me to stop you from searching for typesetting help.

If at any point you have questions about academic integrity and the policies enforcing it, please don't hesitate to ask. You should also familiarize yourself with the official Rutgers policy:

<http://academicintegrity.rutgers.edu/academic-integrity-policy>

## **Assignment Types**

As mentioned above, there are many different types of assignments and activities for you to complete to earn points in this class. Those marked with a \* are assignments that I expect everyone to complete in order to be successful in this course. You are completely free to pick and choose between the others.

### **Foundations Quizzes\***

7 assignments, 20 points each

Since there are no live lectures for the course, you will get your first exposure to the course content via the foundations quizzes. I will be providing readings and videos to help you complete these quizzes. Although you are encouraged to watch all of the provided videos and read all of the provided readings, it is important to remember that the readings and the videos aren't the main point. The point is to complete the quizzes, for which the readings and videos will be helpful. There is no time limit for this activity, and you are welcome to reference the course materials, talk to each other, and ask me questions while working on it. They will be automatically graded, and you can re-submit the quiz as many times as you want before the deadline, with only the highest score being kept. All students should plan to complete the foundations quizzes, as that is your main introduction to the course content.

### **Individual Homework\***

7 assignments, 50 points each

This is similar to traditional homework. You will be assigned typical problems to complete, many coming from the textbook. The submissions will be typed using LaTeX, and one of your early assignments will introduce you to how to do that. Although you each will be submitting your own solutions, you are still welcome to discuss the problems with me and your classmates while working on them. All students should plan to complete the individual homework, as that is the primary place where you can practice implementing the tools and techniques you first learned about in the foundations quizzes.

### **Individual Homework Corrections**

7 assignments, 10 points each

Just as with any course, I will provide feedback and comments on your individual homework submissions. The point of this feedback is for you to learn from your mistakes. However, in a traditional format, there is not much opportunity to learn and grow from this feedback. So, these corrections assignments are exactly what the name suggests: after your individual homework is graded, you can re-do the problems based on that feedback and earn more points for submitting the corrected versions. I highly encourage all students to consider submitting corrections for any individual homework assignments where they miss a lot of points, as this is a prime opportunity to learn and grow.

## **Group Projects**

3 assignments, 100 points each

For each unit of the course, there will be an available group project. These projects must be completed in groups to earn points, and I will help you find group-mates if you don't already have classmates you would like to work with. These projects give your group a chance to apply the techniques learned in that unit in a new context and explore new areas of mathematics. Details about each project will be posted to the Canvas site well in advance. They will each be due in the same weeks as the oral exams are taking place. These projects are a great way to meet your fellow classmates, which can help fight the loneliness that can come from taking an online course.

## **Discussion Boards**

10 assignments, 10 points each

This course is a pivotal transition from more computational courses to a deeper understanding of the theory of mathematics. So, one of the goals of this course is to transition our thinking about what doing mathematics really looks like. Throughout the semester, we will be exploring some of these more philosophical questions about truth and reasoning. The discussion boards will be an opportunity to explore these ideas through communication with your classmates. Each discussion board will have a prompt for you to respond to, and you will earn points by first responding to the original post and then replying to two of your classmates.

## **Blog Posts**

8 assignments, 10 points each

The blog posts will explore similar philosophical issues as the discussion boards but are an opportunity for more personal reflection and exploration. You can choose to write these posts in an actual blog site (using, for example, WordPress or Wix) which you can share with others, or you can just upload the content of such a post to Canvas.

## **Presentations**

14 assignments, 10 points each

Explaining the solution to a problem often requires a deeper understanding than just solving the problem does. To take advantage of the value of explaining things to our classmates, you may choose to create video solutions to problems in the individual homework assignments. In this video, you will explain your reasoning and the final solution. You can do up to two solution videos per homework assignment, and you will get to choose those after you have submitted the homework and gotten feedback. You will post your solution videos to a discussion board on Canvas, so we can all benefit from the explanations of others.

## **Oral Exams\***

3 assignments, 300 points each

At the end of each unit, you'll be taking an oral exam. You can think of these as replacing traditional midterms. There will be a written component, like a take-home exam, which you will complete ahead of time and that will count for 100 of the 300 points for the exam. You will then schedule a time to meet with me one-on-one (virtually, of course) to discuss your solutions and other material that has been covered in this unit. You must have the meeting for the oral component in order to receive credit for the written component. More details about these assessments will be posted to Canvas well in advance. All students should expect to complete all three of these assessments.

## **Final Project/Exam\***

1 assignment, 600 points

This assessment is taking the place of a traditional final exam. I will offer an oral exam, with similar structure to the previous three oral exams, but students will also have other options that they can choose instead for how to earn these points. The goal of this assessment, in whatever format it takes for you, is to demonstrate your overall knowledge gained in the course. More details about this assessment, including some options you can consider, will be posted to Canvas. All students should expect to complete this assessment.

## **Miscellaneous**

### **Introduce Yourself\***

During the first week, students will be asked to introduce themselves to me and to their classmates. This will be accomplished by (1) uploading a profile picture (2) filling out a survey and (3) posting an introduction to a discussion board. Ideally, these introductions will be a video of you introducing yourself but could also be a written paragraph with a picture. Students will earn 20 points for completing this assignment, and all students should plan to do it.

### **Introduction to LaTeX\***

As mentioned above, all of your individual homework is required to be typed using LaTeX. It is not expected that students are familiar with LaTeX before entering this course, or even necessarily know what that is. LaTeX is a typesetting program that allows mathematicians to quickly and cleanly type their documents with many mathematical expressions and formula. As this class is an introduction to the world of mathematics, it is a natural place to learn how to type mathematics. This assignment introduces you to the software and the syntax of typing in LaTeX. All students should expect to complete this assignment, as it will prepare you to type many of the future assignments, and you will earn 50 points for completing it.

### **Semester Plan\***

As mentioned above, after the second week of class, you will put together a plan for (1) what grade you are aiming for in this class, (2) how many points you will need to attempt in order to reach that goal, and (3) what assignments you plan to complete in order to get there. This plan does not commit you to anything but will help you to get off on the right foot. In order to complete this plan most effectively, you are encouraged to try each of the activity types during the first two weeks, to figure out which ones work best for you. All students should expect to complete this assignment, and you will earn 30 points for doing so.

### **Mid-Semester Check-in\***

As mentioned above, you will be asked halfway through the semester to meet with me (virtually, of course) to discuss where you are at, and a plan for achieving your goals by the end of the semester. All students should expect to complete this assignment, and you will earn 20 points for doing so.

## Course Schedule

|                               |  |
|-------------------------------|--|
| <b>Week 1: May 26-29</b>      | Introduction   |
| <b>Week 2: June 1-5</b>       | Foundations  |
| <b>Week 3: June 8-12</b>      | Proving Conditional Statements                             |
| <b>Week 4: June 15-19</b>     | End of Unit 1  |
| <b>Week 5: June 22-26</b>     | Proving Non-Conditional and Multiply Quantified Statements |
| <b>Week 6: June 29-July 3</b> | Disproof and Proof with Sets                               |
| <b>Week 7: July 6-10</b>      | Induction  |
| <b>Week 8: July 13-17</b>     | End of Unit 2  |
| <b>Week 9: July 20-24</b>     | Relations and Functions                                    |
| <b>Week 10: July 27-31</b>    | Cardinality  |
| <b>Week 11: August 3-7</b>    | End of Unit 3  |
| <b>Week 12: August 10-12</b>  | Final Projects   |

## Student Wellness Services

### Just In Case Web App

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

### Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ <http://health.rutgers.edu/medical-counseling-services/counseling/>

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

### Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / [www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

### Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

### Scarlet Listeners

(732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlistenersh>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.

Report a Concern: <http://health.rutgers.edu/do-something-to-help/>