Department of Mathematics
Franklin College of Arts and Sciences
UNIVERSITY OF GEORGIA

Math 3200 – Introduction to Higher Mathematics
Section 25124
University of Georgia
Spring 2020

Course Instructor Information
Instructor: Dr. Jennifer Royal
Pronouns: she/her/hers
Email: jroyal@uga.edu
Phone: (706) 542-2211 (math dept. main number)
Office: Boyd 637A
Office Hours (in Boyd 637A): M 2:30 p.m.-3:30 p.m., W 12:15 p.m.-1:15 p.m., F 10:15 a.m.-11:15 a.m., and by appointment (email jroyal@uga.edu to schedule)

Course Meeting Information
Meetings: MWF 1:25 p.m.-2:15 p.m.
Location: Boyd 304

Course Website
https://faculty.franklin.uga.edu/jroyal/math-3200-spring-2020

Communication Preferences
For outside-of-class communication, I strongly prefer that you contact me via email (sent to my UGA email address). Include your full name and course record number (CRN) in your email, and be sure to email me from your UGA email address. I do not have a telephone in my office; I do not recommend sending messages through eLC.

Office Hours
Office hours are times that I have set aside especially for students to come and discuss math. My goal for office hours (and for the course!) is to help you learn math. When you come to office hours, you can arrive at any time that is convenient for your schedule (not just at the beginning). However, allow yourself enough time to ask questions. Here are some things to do during office hours:

- go over problems you are stuck on
- go back over a class discussion
- talk about why we did something while we were working a problem
- look for more example problems to work through (and work them)
- bring your homework and work on it by yourself or with a group
- ask for advice on study skills, test taking, etc.
- talk about how you are doing in the class

If you want to speak privately during office hours (e.g. about grades), let me know. If

you want to meet with me individually outside of office hours, please make an appointment by email at least 24 hours in advance. If you receive a grade of D or F on any assignment, I expect a meeting as soon as possible.

General Class Information

Course Description
This course covers mathematical reasoning and writing mathematical proofs, the two essential skills for success in upper division course work in mathematics. Topics include logic, integers and induction, sets and relations, equivalence relations, and functions (including injectivity and surjectivity).

Writing Intensive Program
This section of MATH 3200 is part of the Franklin College Writing Intensive Program (WIP). Our WIP TA, Ernest Guico, will work with you extensively to help you write in the language of mathematics. Ernest is a Ph. D. student in the Department of Mathematics at UGA.

Note from the Instructor
This course is your first view of mathematics from the vantage point of a mathematician. In this class, we move away from computational problems (differentiation, Lagrange multipliers, Laplace transforms, matrix inverses, etc.) and work with the very foundations of mathematical thinking. Most students find this course difficult. Here are some pointers:

1. Always know all of the definitions and all of the theorems.
2. When you are stuck:
    a. Read through the recent definitions and theorems, and try to find something relevant. Then read through the older stuff.
    b. Look for similar problems from class, and try to find a technique to imitate.
    c. Go for a walk. Higher-level math is all about letting problems “simmer.” Think about a problem for a while, and then take a break.
    d. Talk to someone about the problem. Sometimes the answer will come to you as you are describing the situation to someone else.
    e. Remember that mathematicians spend all day long thinking about problems they don’t yet know the answers to.
    f. Take a nap. Sleep is magic.
3. Use me as a resource. I am available to you via office hours, via GroupMe, via email, and pretty much any other way you can think of. By the way, my first “proofs” course was a difficult experience.
4. Keep trying. Over the course of the semester, you will learn how to write mathematically correct proofs. As you are learning, you may feel totally and utterly lost; that is actually completely normal.

Active Learning Statement
This is an active learning class. Active learning primarily differs from traditional (lecture-based) instruction because it *requires* you to interact meaningfully with content during class. As I plan our class time, I will focus on your interactions in class: interactions with

content, interactions with other students, and interactions with me. You are responsible for being an active contributor in class. I will encourage you to form connections to your prior learning, and during class time I will interact with you to facilitate your learning in class.

Class Format
Our course format is a type of flipped classroom. We will spend class time on a variety of activities that I have designed to foster your deep understanding of course topics. Outside of class, you will complete reading assignments and pre-class problem sets. Your reading assignments will cover topics before we discuss them in class, so that we can work more efficiently in class.

Diversity and Inclusion Statement
In this classroom, ***you will be treated with respect***, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. (Source: modified from a statement provided by the American Society of Engineering Education)

Classroom Expectations
We will discuss mathematics together on a daily basis. These discussions are important because they provide for a richer classroom discussion, and they ensure that we all encounter different ways -- correct and/or incorrect -- of thinking about the material. It will be important for you to listen attentively to your peers' thinking, even if you think you already have a full solution to the discussion problem. I expect you to respond respectfully and carefully to your peers' comments. When you are working in groups, I expect you to help your group members to all work at the same pace; it will be important for you to keep your peers informed about the choices you are making, and for you to check in with them to make sure they follow your thinking and are ready to move on.

Office Hours
Office hours are times that I set aside especially for students to come and discuss math. When you come to office hours, you can arrive at any time that is convenient for your schedule (not just at the beginning). Be sure to allow yourself enough remaining time to ask questions. Here are some things we can do during office hours:

- go over problems you are stuck on
- talk about questions from class work
- discuss strategies for studying, taking exams, etc.
- talk about how you are doing in the class

If you want to speak privately during office hours (e.g. about your grades), let me know. If you want to meet with me individually outside of office hours, please make an appointment by email at least 24 hours in advance. If you receive a grade of D or F on any assignment, I expect you to schedule a meeting with me as soon as possible.

Student Learning Outcomes

At the end of the semester, a successful student will be able to:

1. Define and correctly use basic vocabulary associated with the following topics:
    a. Logic
    b. The real numbers, especially the integers
    c. Induction
    d. Set Theory
    e. Relations, especially equivalence relations
    f. Functions
2. Generate examples and non-examples of mathematical objects associated with the topics above.
3. Use correct mathematical notation associated with the topics above.
4. Formulate logically sound arguments using style conventions common in mathematical practice.
5. Identify an appropriate proof technique for an assigned proof.
6. Write mathematically valid proofs using the following techniques:
    a. Direct proof
    b. Biconditional proof
    c. Proof by cases
    d. Proof by contrapositive
    e. Proof by contradiction
    f. Induction
7. Write mathematically valid proofs in the following subject areas:
    a. The real numbers, especially the integers
    b. Sets
    c. Relations, especially equivalence relations
    d. Functions

Prerequisite
One of MATH 2210, MATH 2260, MATH 2310H, MATH 2410, MATH 2410H

Assignments and Grading

Course Grade
Your numeric grade will be calculated using the following percentages:

Hand-in problems	10%
Presentations	5%
Participation	5%
Quizzes	10%
In-class Exams (3)	45%
Cumulative Final Exam	25%
Total	100%

Letter grades will be assigned using the following scale:

≥92	89-91	87-88	82-86	79-81	77-78	72-76	69-71	60-68	<60
A	A-	B+	B	B-	C+	C	C-	D	F

Hand-in problems
The purpose of working problems on your own is for you to continue developing your understanding of the material. Struggle is a part of the learning process, and I hope that you will wrestle with problems you do not understand, and that you will grow and learn through this process. I encourage you to write up your hand-in problems and then take a critical eye and re-write as needed. Please come and get help during office hours if you have questions. When your work is graded, it will be graded with the understanding that it is in draft form, meaning that you will get some credit for making progress, even if you are not able to complete that part of the assignment.

Each submitted hand-in problem will be graded out of 10 points. To help you to think critically about the feedback you receive, you will have an opportunity to resubmit your hand-in problems for a higher grade, up to a 9/10. To be considered for a re-grade, you must turn in your revised work to our TA within one week of the date it was returned to you. In order to receive a re-grade, you must attach the entire original assignment and your corrected problem(s). Students who did not turn in the original assignment on time will not be eligible for a resubmission or a late submission.

Presentations
In this class, students will present problem solutions (usually proofs) in front of the class. You will use the When you present a problem, be sure to have the problem statement written at the top of the page. To receive full credit for problem presentations, a student must present at least two correct solutions in front of the class over the course of the semester. You need to be prepared to present every problem, every day.

Participation
To earn your participation points for a day of class, you must *participate* in class on that day. To participate, you must be present, but you also must be involved in whatever activities are happening in class. Specifically, during group work, you must be working on problems with your group. During another classmate's presentation, you must listen attentively to the presentations, take good notes, and ask clarifying questions if needed.

Quizzes
We will have regularly scheduled quizzes. Many quiz questions will be "State the definition of …" or "Define …" Many other quiz questions will be "State … theorem." I will post quiz study guides to our course website, and quiz questions will be chosen from the study guides.

In-class Exams
Our class will take exams during class on the dates below. Your in-class exams will count for 45% of your course grade (each exam counts 15%). If you are absent from a scheduled in-class exam, and your absence is excused (generally, this requires a

medical or legal explanation, with supporting documentation), the grade for the missing exam will be replaced with your final exam grade. If you know in advance that you cannot be in attendance for a particular exam, discuss this with the instructor as early as possible.

Tentative exam dates are listed below; any changes to the testing schedule will be announced by the instructor in class and/or by email.
In-class Exam 1: Friday, February 7
In-class Exam 2: Friday, March 6
In-class Exam 3: Friday, April 24
Cumulative Final Exam: Monday, May 4, from 12 p.m. to 3 p.m., in our classroom

Cumulative Final Exam
In mathematics, success in a course depends on complete knowledge of prerequisite material, so final exams tend to be cumulative. Our final exam will cover all of the material from the entire semester, with a slight emphasis on Taylor Chapter 5. To be ready for the cumulative final exam, I recommend that you deliberately take time to review throughout the semester. If you study frequently in small chunks, you will have an easier time during finals.

If you have three or more final exams scheduled during a 24-hour period, you are eligible to reschedule an exam; mass exams are to be rescheduled first if possible. See the official policy at: https://curriculumsystems.uga.edu/curriculum/finalExamConflicts/

Tentative Course Outline

The schedule and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning. The reading assignments listed next to each day are to be completed *prior to* the specified class meeting. **This schedule will not be updated with changes during the semester; updates will be provided on the course website and/or via email.**

Wk	Mth	Dt	Day	Pre-class (Taylor)	Topic(s)	Class Format	FYI	Extra: Chartrand	Extra: Houston
1	Jan	8	W		Course Intro; Statements	Group Work			
	Jan	10	F	Ch 1 (All)	Statements, Negations	Group Work		Ch 2	Ch 1-4, 15-19
2	Jan	13	M		Statements, Negations	Presentations			
	Jan	15	W		Implications, Quantifiers	Group Work	Ch 1 Quiz		
	Jan	17	F	Ch 2 (All)	Implications, Quantifiers	Presentations		Ch 3-5	Ch 5-12, 20-23, 26
3	Jan	20	M		Holiday: MLK				
	Jan	22	W		Proof Methods	Demo; Group Work			
	Jan	24	F		Dr. George Khalil, CDC	Special Presentation			
4	Jan	27	M		Proof Methods	Presentations			

	Jan	29	W		Proof Methods	Group Work	Ch 2 Quiz		
	Jan	31	F		Proof Methods	Presentations			
5	Feb	3	M	Ch 3 (All)	Induction: Equality	Demo method; Group Work		Ch 6-7	Ch 24-25
	Feb	5	W		Review	Q&A; catch up			
	Feb	7	F		Exam: Ch 1-2	Exam 1	Exam		
6	Feb	10	M		Induction: Equality	Presentations			
	Feb	12	W		Induction: Equality	Group Work			
	Feb	14	F		Induction: Inequality	Presentations			
7	Feb	17	M		Even More Induction	Group Work	Ch 3 Quiz		
	Feb	19	W		Even More Induction	Presentations			
	Feb	21	F		Strong Induction	Group Work			
8	Feb	24	M		Strong Induction	Presentations			
	Feb	26	W		Strong Induction	Presentations			
	Feb	28	F	4.1-4.3	Sets, Set Operations, Set Product, Subset Proofs	Group Work		Ch 1, 4.4, 4.5	Ch 1, 5
9	Mar	2	M		Sets, Set Operations, Set Product, Subset Proofs	Presentations	Ch 4 Quiz		
	Mar	4	W		Review	Q&A; catch up			
	Mar	6	F		Exam: Ch 3-4	Exam 2	Exam		
10	Mar	9	M						
	Mar	11	W		Spring Break Mar 9-13				
	Mar	13	F						
11	Mar	16	M	4.3	Set Equality Proofs	Group Work			
	Mar	18	W		Set Equality Proofs	Presentations			
	Mar	20	F	4.4-4.5	Set Proofs	Group Work (Withdraw Deadline)			
12	Mar	23	M		Set Proofs	Presentations			
	Mar	25	W	5.1-5.2	Relations, Equivalence Relations	Group Work		Ch 9	Ch 1, 31
	Mar	27	F		Relations, Equivalence Relations	Presentations			
13	Mar	30	M		Relations, Equivalence Relations	Group Work	Ch 5 Pt 1 Quiz		
	Apr	1	W		Relations, Equivalence Relations	Presentations			
	Apr	3	F		Relations, Equivalence Relations	Group Work			
14	Apr	6	M		Relations, Equivalence Relations	Presentations			
	Apr	8	W	5.3	Functions	Group Work		Ch 10	Ch 30
	Apr	10	F		Functions	Presentations			
15	Apr	13	M		Functions	Group Work			
	Apr	15	W		Functions	Presentations	Ch 5 Pt 2 Quiz		
	Apr	17	F		Functions	Group Work			
16	Apr	20	M		Functions	Presentations			

	Apr	22	W		Review	Q&A; catch up			
	Apr	24	F		Exam: Ch 4-5	Exam 3	Exam		
17	Apr	27	M		Review	Course Review			
	Apr	28	T		Review	Last Day; Monday Class Schedule			
	Apr	29	W		Reading Day				
	May	4	M		Final Exam	12 p.m. - 3 p.m.			
	May	11	M		Grades due on Athena				
	May	12	T		Grades visible on Athena				

Classroom Policies

Course Materials

You will have required assignments from the free online intro to proofs text by Dr. Ron Taylor, which is available at this link: http://www.jiblm.org/downloads/jiblmjournal/V070404/V070404.pdf (Note that the paperback by the author is different; please print the free PDF if you want a physical book.)

You will also have optional assigned readings from *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics* by Kevin Houston (ISBN 978-0-521-71978-0) and *Mathematical Proofs: A Transition to Advanced Mathematics*, 4th Edition by Chartrand, Polimeni, and Zhang (ISBN 978-0-134-84047-5). An old edition will work fine, but the chapter numbers may be different. You may also have assigned readings from various other free materials that will be posted to our course website.

Email Policy

I welcome emails from students; please give me at least 48 hours to respond. (For weekend emails, that means 48 business-day hours, which means Wednesday morning.) I will get to your emails as quickly as I can; sometimes life intervenes and makes it difficult for me to respond right away. Be sure to work on assignments in advance so that you have enough time to get your questions answered.

Electronics Policy

Laptops*, cell phones, tablets*, smart watches, etc., may not be used in class. You may not have a smart watch or other personal electronic device on your person during a quiz or exam; these devices must be stored in a backpack or purse. Your personal electronic devices must be in “silent” mode during class; a ringing or vibrating device disrupts the classroom experience. I understand that there may be times when you need to be connected (childcare issues, family emergencies, etc.). If such a situation arises, please step outside and address these as needed. If you repeatedly violate this policy, you will be asked to leave the room immediately. No exceptions.

* I will make one possible exception to this policy. If you are legitimately using one of these devices for note taking purposes, you must request permission from me in person. If granted, you may be required to email your notes to me at the end of every

class. I reserve the right to revoke permission if I feel this policy is being abused or becomes disruptive to others.

Attendance Policy
A student who is not fully engaged in class activities is considered absent for the day. Students are allowed no more than 3 unexcused absences. **On the fourth unexcused absence, a student may be withdrawn from the course with a grade of W before midpoint, F after midpoint.** Do not regard these 3 allowed absences as "personal free days". These are only to be used in cases of personal or family emergencies. In some cases, verification may be required. I will work with any student who has a documented emergency, so please let me know as soon as possible if something is going on. Social functions, work, weddings, etc. do not count as excused absences. Let me know if you will miss class for an excused absence; if so, I may allow you to complete in-class assignments early. In the event that the university cancels our class, any assignments scheduled to be due that class day will be due the next time the class meets.

Deadline Policy
Any work that is not submitted on time will receive a grade of zero. You are responsible for submitting assignments on time, even following an absence. I will work with any student who has documented extenuating circumstances of a medical or personal nature (illness of self or family member, mental/emotional wellness concerns, etc.).

Academic Honesty Policy
As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: https://honesty.uga.edu/Academic-Honesty-Policy/. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

Specific Academic Honesty Guidelines for This Course You may not discuss any aspect of any exam until it has been graded and returned to you, unless you have been given explicit permission to do so. You are allowed to discuss homework and presentation problems with others. The following are examples of academic dishonesty and are prohibited in this course:

- getting a solution from the internet, a textbook, a classmate, etc. and presenting it as your own
- using unauthorized materials during a test situation, including cheat sheets, the internet, another person's test paper, etc.
- having a cell phone or smart watch accessible during a testing situation, even if you are not using it to find problem solutions

This is not an exhaustive list; rather it is meant to give you an idea of the kinds of activities that are prohibited. Review the full academic honesty policy at https://honesty.uga.edu/Academic-Honesty-Policy/.

General Operating Policies and Procedures

FERPA Notice
The Federal Family Educational Rights and Privacy Act (FERPA) grants students certain information privacy rights. See the registrar's explanation at https://apps.reg.uga.edu/FERPA/

Course Evaluations
I encourage you to complete the online evaluation near the end of the semester. Student evaluations of teaching are used by university administrators to evaluate instructional faculty. I also take your feedback seriously; note that it is delivered anonymously and is not visible to me until after I have submitted all final course grades.

Office of Student Care and Outreach
If you have a personal crisis during the semester, you will want to contact the Office of Student Care and Outreach so that they can support you: https://sco.uga.edu/sco/services-students

Accessibility Statement
If you anticipate issues related to the format or requirements of this course, please meet with me. I would like us to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with the Disability Resource Center located in Clark Howell Hall (Voice: 706-542-8719 or TTY: 706-542-8778 or Web: https://drc.uga.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations. If you have a documented disability, I strongly encourage you to register now with the DRC so you have access to any accommodations that you may need throughout the semester.

Disclaimer
The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary. It is the responsibility of the student to seek clarification of the grading policy and/or course requirements and procedures from the instructor.