Math 381: Real Analysis   **2021**
Elementary Analysis, Ross
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Course Objectives: *Continue to learn how to do mathematics!* Mathematics is a problem-solving discipline, and we all have room to improve. To develop as problem-solvers, we must focus on technique and not on memorization. In this course, we focus on the basics of calculus, this time with an emphasis on precise details. How can we prove that the techniques we use in calculus are correct? More importantly, when are these techniques not valid? We will look at some very unusual functions that we can analyze but that defy intuition and the basic techniques learned previously. We take a step into the world of mathematics, where definitions and logic rule!

Intended Learning Outcomes: At the end of the course, successful students will be able to
- Use definitions of calculus terms to solve problems and contrast with other terms
- State important calculus theorems and know when they are not valid
- Use proof techniques to progress from one calculus result to the next
- Apply calculus definitions to complicated functions of theoretical interest

Attendance Policy: Attendance and attention in class is essential! Work hard in class and you will have little need for studying the night before a test. You are responsible for everything done in class, through attendance and sharing class notes with classmates. If you miss a class, e-mail or call me before class is over and explain why. With the first unexplained absence, you and your advisor and the registrar will be warned that another unexplained absence will result in removal from the course. **If you have two unexplained absences, you will be dropped from the course.**

Equipment: We will use Mathematica for some messy calculations, but mostly you will be using your brain and lots of pencil and paper to work and rework problems. When working on a proof, it is very hard to tweak a mistake – start over and make sure the logic is correct.

Homework and Projects: There will be regular hand-in homework. You will have class time to work on these problems and ask questions – use this time wisely! In class, you may ask questions of each other (and me) and talk through ideas. However, **do not copy** someone else's work! Do not copy proofs from online! Unlike computing a derivative, each individual's proof should be distinct from others – we all think and communicate differently. There will be 3 projects, which are extended problems that go beyond standard homework problems in logic and scope.

Quizzes: Every class, other than test days, will start with a brief 5-minute quiz. The quiz ends at 10:15, so get to class on time! Quiz topics will typically be statements of definitions or named theorems. These are the basic elements of understanding Real Analysis, so commit to learning these like you would a calculus derivative formula. Given the precise nature of mathematics, a small change in language can change the meaning of a statement, so be careful if you paraphrase a definition or theorem. You will be graded on a scale of 0 (not turned in) to 3 (perfect).

Co-Curricular: During the course of the semester, you must attend at least three co-curricular events approved by the MCSP department. For each, write a two-paragraph reflection paper, giving a brief summary of the talk and expanding on some aspect of particular interest to you. Reports are due within a week of the talk. One report must be turned in before fall break.

I expect you to spend at least 12 hours of work each week inside and outside of class.

Tests: There will be two tests and a final exam. Each test will have an in-class portion and a couple of take-home problems. Test dates are Th 10/14 and Th 12/2. The final exam is Thursday, 12/16 at 8:30.

Make-ups: In case of sickness or scheduling conflicts, get in touch with me ASAP.

Academic Integrity: The college policy is fully supported. Tests are closed notes, closed book unless noted. Electronic devices other than computers are not allowed in test situations, and computers may only be used for computation purposes in Mathematica.

Grading:

Quizzes: 10%	Homework: 20%
Projects: 24%	Participation: 6%
Tests: 30%	Exam: 10%

Grades may be curved up based on extenuating circumstances, including improvement as the semester goes on.

A: 93-100 A-: 90-92
B+: 87-89 B : 83-86 B-: 80-82
C+: 77-79 C: 73-76 C-: 70-72
D+: 67-69 D: 63-67   D-: 60-62
F: 59 and below

Community: Welcome back to the mathematics community! I hope you will take advantage of the opportunities available in our department. You may get to know us and other students in the MCSP Study Room (Trexler 271) which is near most of the faculty offices. Please take the time to get to know your fellow students. They can be a great resource for you! Utilize office hours and all opportunities to ask questions and get help from me. Get involved with campus activities! If you are interested in sports analytics (*Moneyball*) ask me for information on Stat Crew.

We will follow mask/distancing guidelines established by the college, out of respect for the health of others. As the pandemic allows, we will work together and get to know each other.

Math 381 Schedule

Date	Sections	Topics	Problems
Th 9/2	1-5	Numbers	1.2,1.3,1.7,2.1,2.2,3.5,5.2,5.3
T 9/7	7,8	Sequences, Proofs	7.3,7.4,7.5,8.1,8.2,8.3,8.7
Th 9/9	9	Theorems	9.1,9.2,9.5,9.6
T 9/14	9	Theorems	9.9,9.10,9.13,9.16
Th 9/16	10	Cauchy Sequences	10.1,10.6,10.7,10.8,10.9
T 9/21	11	Subsequences	11.1,11.2,11.3,11.11
Th 9/23	12	lim sup	12.1,12.3
T 9/28	Project #1: Representation of Numbers		
Th 9/30	17	Continuity	17.1,17.3,17.8,17.9ab,17.10,17.13
T 10/5	18	Properties	18.1,18.3,18.4,18.5,18.7,18.8,18.9
Th 10/7	19	Uniform Continuity	19.1,19.2,19.4a,19.7a
T 10/12	20	Limits	20.1,20.3,20.5,20.11,20.13,20.16
Th 10/14	TEST #1		
FALL BREAK			

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Date	Sections	Topics	Problems
T 10/26	23	**Power Series**	**23.1 (radius),21.5a**
Th 10/28	24	**Uniform Convergence**	**24.1,24.2,24.3,24.4,24.10-11**
T 11/2	28	**Derivative**	**28.1,28.2,28.5,28.7,28.8**
Th 11/4	29	**Mean Value Theorem**	**29.1,29.3,29.4,29.9,29.13**
T 11/9	30	**L'Hospital's Rule**	**30.1,30.2,30.5,30.6**
Th 11/11	**Project #2: Weierstrass Function**		
T 11/16	32	**Riemann Integration**	**32.1,32.2,32.3,32.6,32.7**
Th 11/18	33	**Properties**	**33.1,33.3-5,33.8b,33.12-13**
T 11/23	34	**Fundamental Theorem**	**34.2,34.3,34.5,34.6,34.7,34.8**
T 11/30	35	**Riemann-Stieltjes**	**35.3,35.4,35.5,35.8**
Th 12/2	**TEST #2**		
T 12/7	**Project #3: Newton's Method**		
Th 12/9	**Review**		
M 12/16	**Exam 8:30-11:30**		

Math 381 Information Sheet

Name:

Email:

Cell phone:

Major(s):

Hometown:

List the math/stat course(s) you took last year.

How hard do you expect real analysis to be? How interesting?

Why is calculus important?

What are some of the co-curricular or other campus activities you would like to participate in this year?