Instructor: Dr. Chris Lee clee@roanoke.edu Trexler 270D

Office Hours: Have a question? Please stop by my office to chat. Regular office hours are listed below, and I welcome you to contact me to make an appointment outside of these hours:

Tue: 2:50-4:00pm, Wed: 1:10-2:40pm.

Course Objectives: Borrowing from the author of the text: *The aim of this course will be to challenge and improve mathematical intuition rather than simply verify it. This will be done by taking a mathematical rigorous approach to the study of functions of a real variable. While many of the topics will seem familiar from your calculus courses, the focus will not be on concepts that are easily visualized. Most of our work will involve complete understanding of definitions, applying them in contexts where simple intuition will fail, and extensive use of formal proofs as communication.*

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: Come to class and be prepared to actively participate - this is the best way for you to engage in the learning material and it makes our class meeting so much more fun! You should attend every class, but extenuating circumstances can arise that can make this difficult. If you cannot attend a class, please let me know. If circumstances cause you to miss more than 3 classes during the semester, you may be overextended and should consider dropping the class.

Reading and Participation: Key to learning is participation. We will strive to have an active, rather than passive, classroom environment. I fully hope that you will have read the upcoming section before the class meeting. You most certainly will not understand everything while you are reading ahead, but having read the section will allow you to ask questions and participate better in class.

Late & Missed Work: Unfortunately, illnesses, death in the family, or other traumatic events are part of life. Such events are unwelcome and because I understand how difficult these times are, if you contact me within 24 hours of the event and provide documentation, I will be happy to extend deadlines and/or provide make-up work.

Expected Hours of Work: To be successful in this course it is anticipated that you will put in at least 12 hours of work inside and outside of class each week.

Academic Integrity: Students are expected to follow the integrity policy detailed in the handbook *Academic Integrity at Roanoke College*. Additionally, if you are ever uncertain as to how the College's policy pertains to any assignment or exam in this course, please ask me for clarification. The bottom line is that all work that a student submits for a grade must be ***solely*** the work of that student unless the instructor has given explicit permission for students to work together. If students are working in groups, all members must equally participate.

Engagement and Practice: It is wonderfully easy to watch someone else write a proof on the board, or to read one out of a textbook. It is an entirely different experience to produce a proof yourself on blank paper. To this end, we will spend considerable class time engaged in writing. This may be individual, in groups, or at the board. To assess this activity this course will include:

- Daily Homework**:** There will be regular hand-in homework. Work on this may begin during class time and continue outside of class. If given the opportunity to work together, be very conscious of the fact that if both participants are not actively contributing to the work we have an academic integrity issue.
- Daily Quizzes: Most class days will start with a brief quiz, do not be late to class or you may miss it. 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. These will be graded on a scale of 0 (not turned in) to 3 (perfect).
- Testing: There are two tests and a final exam. Each test will have an in-class portion and a couple of take-home problems.

Everything is Cumulative: You will find that virtually every day in class we will be combining information from previous chapters with material we are currently studying, and this pattern will carry over to all your graded work. I am committed to helping you put together a large course basket of knowledge this semester and to giving you frequent opportunities to practice retrieval of this knowledge. To that end, all quizzes, tests, and the final exam are cumulative. On any one of these approximately 50% of the assessment will be on fundamentals of previous material and 50% on new material.

Course Grade Calculation: There are 5 graded components of this course, each are weighted at 20% :

Quizzes, Homework, Test 1, Test 2, Final Exam.

A scale will for final grades will not be lower than the scale given below.

0	*60*	*63*	*67*	*70*	*73*	*77*	*80*	*83*	*87*	*90*	*93*	
F	*D-*	*D*	*D+*	*C-*	*C*	*C+*	*B-*	*B*	*B+*	*A-*	*A*	

Math 381 - Daily Class Schedule

The Real Numbers, Sequences and Series

Tue	Jan 17	1.1, 1.2	Preliminaries
Thu	Jan 19	1.3, 1.4	The Axiom of Completeness & Consequences
Tue	Jan 24	1.5, 1.6	Cardinality and Cantors Theorem
Thu	Jan 26	2.1, 2.2	The Limit of a Sequence
Tue	Jan 31	2.3, 2.4	Algebraic & Order Limit Theorem, Monotone Convergence
Thu	Feb 2	2.5	Subsequences and Bolzano-Weierstrass
Tue	Feb 7	2.6, 2.7	Cauchy Criterion, Properties of Infinite Series
Thu	Feb 9	Review	
Tue	Feb 14	**Test 1**	

Basic Topology of R, Function Limits & Continuity, The Derivative

Thu	Feb 16	3.1, 3.2	Open and Closed Sets
Tue	Feb 21	3.3, 3.4	Compact, Perfect, and Connected Sets
Thu	Feb 23	4.1, 4.2	Functional Limits
Tue	Feb 28	4.3, 4.4	Continuous Functions, Compact Sets
Thu	Mar 2	4.5	Intermediate Value Theorem
Fall Break			
Tue	Mar 14	5.1, 5.2	Derivatives and Intermediate Value Theorem
Thu	Mar 16	5.3	Mean Value Theorem
Tue	Mar 21	Review	
Thu	Mar 23	**Test 2**	

Sequences and Series of Functions, The Riemann Integral

Tue	Mar 28	6.1, 6.2	Convergence of a Sequence of Functions
Thu	Mar 30	6.3	Uniform Convergence and Differentiation
Tue	Apr 4	6.4	Series of Function
Thu	Apr 6	6.5, 6.6	Power Series & Taylor Series
Tue	Apr 11	7.1, 7.2	How Should Integration Be Defined? Riemann Integral
Thu	Apr 13	7.3	Integrating Functions with Discontinuities
Tue	Apr 18	7.4	Properties of the Integral

Thu	Apr 20	7.5	Fundamental Theorem of Calculus
Mon	May 1	**Final Exam**	8:30-11:30am