MATH 4320 Syllabus
Analysis I
Summer II 2025 Sul Ross State University

Secs. **201**	Mon, Tue, Wed, Thu, Fri: 10-11:40a in ACR 205
Instructor:	Dr. Kris Jorgenson
Office:	ACR 109D
E-mail:	kjorgenson@sulross.edu
Office Hours:	Mon, Tue, Wed, Thu, Fri: 11:40a-12:00p, 2-4p
	also by appointment

Course Description: The prerequisite is Calculus III (Math 3415), or consent of the instructor. This course will take on the traditional analysis topics: properties of the real numbers, sequences and series of real expressions, and rigorous proof of the fundamental elements of calculus, such as limits, continuity, and differentiability of functions of a single real variable by following a historical perspective. We will examine the investigations into the assumptions of calculus that amounted to a thorough reconstruction of calculus that warranted a new name: Analysis. We will study the questions and challenges met by the great mathematicians of history such as Archimedes, Euler, Cauchy, and others not only through rigorous proof-writing, but also through exploration using modern technology.

Student Learning Objectives Successful students will demonstrate correct understanding and knowledge of the topics including but not limited to those of the preceding paragraph. Students will apply concepts and problem-solving methods to different problem-solving situations. Students will demonstrate correct knowledge of the difference between numbers that are in exact form (perhaps in the context of another mathematical object such as a function or algebraic expression) and numbers that are approximate and will be able to report numbers in exact form and with a correct approximation when required. Students will express their solutions clearly in writing using complete sentences.

This course is supportive of the
Student Learning Outcomes for the Bachelor of Science degree in Mathematics:

1) The student will be able to demonstrate content knowledge of basic mathematical principles.

2) The student will be proficient in logic, able to negate statements, provide counterexamples to false statements, and determine the validity of arguments.

3) The student will be able to communicate mathematical content clearly and with valid reasoning.

Program Marketable Skills:

Marketable Skill (MS) 1: Students Demonstrate Logical and Analytical Skills.

MS 2: Students Demonstrate Problem-Solving Using Analytic and Algebraic Methods.

MS 3: Students Use Technology in Problem-Solving and Presentation.

MS 4: Students Use Communication and Pedagogical Skills.

Required Materials: **No Textbook is required**. The course content will be based on the instructor's notes from various sources including
A Radical Approach to Real Analysis, by David M. Bressoud, 2nd Edition, 2007 ISBN: 978-0-88385-747-2 published and distributed by the Mathematical Association of America (MAA).

Class Materials: Students are expected to be prepared in every class with pencils and paper to take notes of lecture content and examples, and you are required to be involved in in-class assignments and discussion. This will be part of your grade.
Blackboard: Also you are required to have access to Blackboard and have an e-mail address that you check regularly be your e-address registered in Bb since I may need to contact you outside of class with important information.

Grading and Assignments: The assignments discussed below will help students achieve all of the Student Learning Objectives mentioned previously through active learning and assessment. Your total grade will break down as follows:
Homework (**HW**) **grade** (worth 20%), **3 tests** (worth 70%), and **attendance and class participation** (10%). **Optional Individual Project Problem** to supplant 10% of the test average.
The **tests** will be based on assigned homework. The HW grade will include homework handed in, but in-class presentations and a notebook grade may also be used as part of the homework grade. Test 3 will cover new material but also will include some material from the 1st two tests. The tests will be given in class on the following dates:

Test 1	**Thu**, **July 17**
Test 2	**Fri**, **August 1**
Test 3	**Wed**, **August 13**

As this is a face-to-face course, attendance and class participation can only be earned in class. If a student needs to meet remotely, then arrangements can be made so that this 10% of your grade is shifted to be included in your test average so that the test average will count as 80% of your total grade.

I want to give students the option of working on an **Individual Project Problem** (**IPP**) worth **10**%, which will be an individual problem that each student will pick with instructor approval that will be more than a homework problem, but less than a formal paper. The **IPP** will be an application problem over a topic covered in one of the units of study and will be different for each student and must be approved by me. I will have some suggested problems for this, but a student may pick a problem of interest from our resources as long as it has my approval. Each student's IPP must be chosen and approved by me on or before Friday, Aug. 1 and completed by Fri. Aug. 8. It is best to hand in the IPP before this date so that there is time for discussion and corrections so that you can get full credit on the IPP.

I give letter grades according to the traditional 90%-100% for an A; 80-89% for a B; 70-79% for a C; 60-69% for a D; and less than 60% for an F; with some exceptions. Students whose total average is between 50-59% with Test Average over 50% will often be rounded up to a D but only if the student has completed every major assignment (no

exceptions) while doing their best work. Students working similarly who end up with a final grade that is a borderline grade of 89%, 79%, or 69% will often be rounded up to the next grade-level as long as their test average is in line with this total average.

Late Work, **Rescheduled Quizzes/Tests** To take an in-class quiz or test for full credit at a time other than the scheduled time, you must notify me of this absence ON OR BEFORE THE DAY MISSED, and satisfy one of two requirements: either (1) supply a written medical excuse signed by a medical professional for the day of the absence, or (2) your excuse is for a university activity, in which case you must notify me of this authorized absence in writing with your name, the name of your organization and the date(s) of your absence, and your name must appear on a published explained absence list that I am provided (or this is verified by a faculty sponsor). Also, you and I must set up a time for you to make up the quiz or test within a reasonable time period (not more than 2-3 days) before or after the time of the missed grade. Usually I will let you make up a grade according to the above conditions if it is due to another one-time occurrence, such as the care of someone else in your family or a friend, or for a work-related excuse as long as you can document your absence and you let me know BY THE DAY OF THE ABSENCE AT THE LATEST.

Attendance I will be taking attendance as university policy precludes you from missing 5 classes or more (3 weeks or more of a long semester, which is approximately the same class time as 5 or more classes of this type of summer term) for anything other than authorized university activities. To excuse an absence for a university activity, in addition to letting me know of the absence by the day of the absence (as explained previously) you must also spend at least 90 minutes outside of class on this course with me. Also I will allow you to excuse a test day for a documented medical absence as long as you also make up the test. If you have 5 classes or more of undocumented absences, I reserve the right to drop you from this class with a grade of 'F', which is university policy.

Good Advice Concentrate on learning the material of the course rather than worrying about your grade. Your time is best spent concentrating on the material to be learned in the impending assignments, asking questions, and devoting yourself to activities that will help you learn the material and do better in the course. I will worry about the details of your grade since you doing so does not help you earn a higher grade. But learning the material and doing well on the tests *will* help your grade. **Remember that math is not a spectator sport**, so the more problems that you work yourself, the more practice you will get, the more confident you will be, and the better you will do in this course. Working on the problems helps you to figure out what your specific questions are.

It is important to be working on the homework assignments yourself so that you will undergo the personal growth necessary for success on the tests. Making mistakes and learning from your mistakes is an important part of the learning process in mathematics. But you won't have this growth important for success if you are not doing the homework yourself and then asking questions. Losing some points on a homework assignment or quiz will not count for a lot, but if you learn from these mistakes, then you will do better on the tests, which do count for a lot of your grade. So working on the homework yourself, asking questions, and learning from mistakes is **essential** to your success in this course. The best lessons learned often come from correcting a quiz or homework problem in which you have made a mistake.

Remember that LEARNING FROM MISTAKES + PERSISTENCE = SUCCESS!

More Good Advice

Keep absences to a minimum. You never know when you might miss something important either from the lecture or class discussion such as questions other students ask. Remember: YOU ARE RESPONSIBLE FOR EVERYTHING THAT IS DISCUSSED DURING CLASS WHETHER YOU ARE PRESENT OR NOT.

Also do not allow yourself to develop bad habits such as missing classes. It's human nature to be controlled by our habits, so once you develop a daily habit for this summer session, it can be hard to break this habit. So be sure that you allow the necessary time for this course, FROM THE BEGINNING OF THE TERM, ESPECIALLY if you consider mathematics not to be your best subject. If you have trouble in math, then you should attend EVERY class of a college mathematics course. Not showing up to class or not doing the required work will not cause this class to magically "go away". If you are not understanding the material and/or have fallen behind in your work, missing class will not help. IF YOU FALL BEHIND, PLEASE DO NOT DROP THIS COURSE WITHOUT TALKING TO ME FIRST. Making mistakes or falling behind is natural, so it is best to talk to me about this. If you do have to miss class, let me know know before class. Discuss with me what you are not understanding. It is essential to get your questions answered. But meeting with me outside of class is not a substitute for attending class.

Ask questions no matter how easy or trivial they may seem. There is no such thing as a bad or silly question. Questions result when you are interested and have been thinking about areas, such as mathematics, in which you have some limitations in your educational background. Being in a college mathematics course means you will have questions both obvious and more subtle. Asking questions is a very important part of the learning process.

Study and work problems regularly–every day. Work on assignments discussed in class as soon as you can after class while the methods discussed are still fresh in mind. You can't expect to succeed in a math course by waiting till the last minute to only study and cram immediately prior to a test. If you promise yourself you will study for ½-hour, get into the work, forget the clock, then the next thing you know, you've studied and worked for one or two hours.

Classroom Conduct It is important to conduct yourself in a college classroom so that everyone can benefit from good communication between instructor and students. My goal is to create a classroom environment in which everyone can do their best work, learn, and make the best grades possible.

I think you will find that I am a very friendly, sympathetic, and generous instructor as long as you are sincerely working to succeed in this course and certain guidelines for classroom behavior are followed during class to allow a sanctity of study for your fellow students. Habits such as holding conversations during class, or being engaged in activities not related to this course such as working on a different course or reading your cell-phone will work against the goals of this course and cause you to be counted absent and you will lose attendance/participation credit. Also engaging with electronic communication devices of any kind during class or coming into class more than 5 minutes late or leaving early before class is dismissed circumvent the goals of this course and cause you to lose credit. My sympathy and generosity will quickly evaporate if I find that you are working against the goals of the course or that you are simply trying to get a good grade without learning or without honestly doing the required work. I want you to have every opportunity to succeed in this course.

Please be aware of the rules for Academic Honesty that you will find in the Sul Ross

Student Handbook. Use commonsense to think of anything else that will allow you to learn and do the best work that you can in this course, and me to better help you do your best work. Remember that being registered for this course does not allow you to behave in any manner you wish during class. You must keep other people in mind. It is within university policy for me to send a student out of this class on a temporary or permanent basis if disruptions or interruptions like the types listed above persist.

SRSU Accessibility Services. Sul Ross State University (SRSU) is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility/accommodations services must contact Mrs. Mary Schwartze Grisham, LPC, SRSU's Accessibility Services Director or Ronnie Harris, LPC, Counselor, at 432-837-8203 or email mschwartze@sulross.edu or ronnie.harris@sulross.edu. Our office is located on the first floor of Ferguson Hall, room 112, and our mailing address is P.O. Box C122, Sul Ross State University Alpine, Texas 79832.

Required Student Responsibilities Statement

All full-time and part-time students are responsible for familiarizing themselves with the Student Handbook and the Undergraduate & Graduate Catalog and for abiding by the University rules and regulations. Additionally, students are responsible for checking their Sul Ross email as an official form of communication from the university. Every student is expected to obey all federal, state and local laws and is expected to familiarize themselves with the requirements of such laws.

Classroom Climate of Respect

Importantly, this class will foster free expression, critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility, and respect for the viewpoints of others. Similarly, we must all learn how to probe, oppose and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another on the basis of race, religion, ethnicity, age, gender, national origin, or sexual preference. Still we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.

Important University Dates

Mon, July 7	First day of classes, first day of late registration
	and schedule changes
Wed, July 9	Last day for late registration and schedule changes, payment deadline 4 pm
Thu, July 10	4th Class Day
Fri, August 1	Last day to drop a class with a grade of "W" for Summer II
	by 4 pm in University Registrar's Office
Wed, August 13	Final Examinations, End of Term

Tentative Course Outline

Monday, **July 7**: First Day of Classes, Archimedes method of exhaustion for exact area; Geometric Series; Proving limits of sequences.

Tuesday, **July 8**: Proofs of Convergent Series; Proving Absolute Value Properties.

Wednesday, **July 9**: Arctangent series, Leibniz Pi Series, Manchin Pi Series, Combinations

Thursday, **July 10**: Binomial Theorem, Newton's Binomial Series, Log Series

Friday, **July 11**: Alternating Harmonic Series, Harmonic Series,

Monday, **July 14**: Euler's Gamma Constant, Nested Interval Principle (NIP), Diverging Series

Tuesday, **July 15**: Series Diverging to Infinity

Wednesday, **July 16**: Review for Test 1

Thursday, **July 17**: **Test 1**

Friday, **July 18**: Taylor Series and La Grange's Remainder Theorem; Cauchy's Definition of Differentiability

Monday, **July 21**: The Mean Value Theorem; Non-Differentiability

Tuesday, **July 22**: Generalized Mean Value Theorem; Continuity and Limits of Functions; Intermediate Value Theorem

Wednesday, **July 23**: Continuity sustained by sums, products, reciprocals, and compositions of continuous functions

Thursday, **July 24**: Differentiability implies continuity, Continuity implies Boundedness

Friday, **July 25**: Least Upper Bounds, Greatest Lower Bounds; Upper Bound Implies Least Upper Bound; Lower Bound Implies Greatest Lower Bound

Monday, **July 28**: Continuity implies Bounds Achieved (Extreme Value Theorem); Fermat's Theorem on Extrema

Tuesday, **July 29**: Rolle's Theorem; Proof of Mean Value Theorem

Wednesday, **July 30**: Proof of La Grange's Remainder Theorem and the Taylor Series Theorem

Thursday, **July 31**: Review for Test 2

Friday, **August 1**: **Test 2**

Monday, **August 4**: Divergence Theorem; Cauchy criterion; Cauchy sequences and series

Tuesday, **August 5**: Completeness and the Completeness Theorem

Wednesday, **August 6**: The Absolute Convergence Theorem; Conditional Convergence

Thursday, **August 7**: Alternating Series Test; Proof of Irrationality of Radical Irrationals

Friday, **August 8**: Proof of the Irrationality of e

Monday, **August 11**: Review for Test 3

Tuesday, **August 12**: Review for Test 3

Wednesday, **August 13**: **Test 3**