

MA 334: Introductory Real Analysis I, Fall 2019, Alabama School of Math and Science

Instructor: Sarah Brewer

Classroom/Office: S201

Office Hours: Monday 7th, Tuesday 7th, Wednesday 9th, Thursday 4th, Friday 2nd

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Text: Reed, Fundamental Ideas of Analysis, 10th edition.

Coverage: 1.1-1.4, 2.1-2.2, 2.4-2.6, 3.1-3.3, 4.1-4.3, 4.5 (as time allows)

Prerequisites: "A" in both MA201 Differential Calculus and MA202 Integral Calculus or permission of the instructor.

Course Description: This course is designed to provide students with the theoretical context of concepts encountered in the Calculus sequence. Topics include sequences and series of real numbers, suprema and infima, Cauchy sequences, open sets and accumulation points in Euclidean space, completeness, compactness, connectedness, continuity, Intermediate Value Theorem, differentiation of functions of one variable, integration of functions of one variable, pointwise and uniform convergence, Mean Value Theorem, Taylor's Theorem, Inverse Function Theorem, Implicit Function Theorem.

Grade determination: Grades will be assigned based on total points earned out of total points possible. Assignments and grades will be posted on Netclassroom.

Homework assignments are the primary assessment to be used in this course. You will have practice writing and revising mostly proofs, as well as some problem solving. Credit will not be given for answers copied from the internet or from another student. Show all of your own work and make notes if there were problems that gave you particular trouble so that you can ask questions. Some assignments may be submitted via turnitin.com. Point values will vary based on the length of the assignment.

Quizzes will be given regularly at the beginning of class (at least weekly, at most daily—always be ready for a quiz!), and will be a combination of theory (rules, definitions, and formulas) and problems similar to and/or directly from homework assignments. Point values vary, but are usually in the 5-10 point range.

Recommended Materials: Successful students are organized. By keeping your class notes, practice problems, assignments, and study materials organized, you will have an easier time asking for and receiving help, and will have an easier time reviewing for tests. I suggest that students keep a 3-ring binder with notebook paper and dividers, regularly updating this notebook with reflections on assignments, performance, and learning.

Calculators: Students will have in-class access to both scientific (TI-36 X Pro) and graphing (TI-nSpire CX CAS) calculators. For any out-of-class assignments requiring calculator use, students are encouraged to utilize wolframalpha.com and desmos.com. Calculators will not be allowed at all on many assignments.

Teaching philosophy: Everyone can learn mathematics. To do mathematics is to learn how to figure things out. One must work through the frustration, sometimes returning to a problem again and again, and finally enjoying the satisfaction that only comes from hard work. This hard work does not have to be done in a vacuum or bubble. Mathematics is an inherently collaborative discipline, where experts share their knowledge and ideas are discussed and bounced around. Mathematics is best learned by studying with others and probing one's instructors for knowledge and answers to questions you don't even know you have. That satisfaction of having solved a problem for oneself, though, is ultimately an individual experience. Each individual's understanding of a problem, even a problem worked on with others, is a valid contribution to the collective body of mathematical knowledge.

Make-up policy: Any homework, quizzes, or tests missed due to unexcused absences will receive a grade of zero. Homework assigned during a student's absence must be turned in within three days of the student returning to class. If a student misses a quiz or test with an excused absence and a make-up assignment is available, it must be made up within 3 days of a student's return to class. Arrangements to make-up tests must be done BEFORE the test is missed. In case of unexpected illness, this can be done via email. Note: make-up assignments will, in general, be more difficult than the original.

Cell phone policy: Phones should be SILENT or OFF (not on vibrate) and away. I reserve the right to confiscate any phone that I deem a distraction. Use of cell phones during quizzes or tests will be considered academic dishonesty and result in a grade of zero. Cell phones, along with other personal belongings (including smart watches), will be placed at the front of the classroom during tests/exams. Occasionally, we may use smartphone apps in class, but phones should remain away unless otherwise specified.

Attendance and Tardiness Policy: A student will be counted tardy after five minutes from the beginning of class. Three tardies count as one unexcused absence. A student will be counted absent after 15 minutes from the start of class, or if they leave the class for 10 minutes or more. A student with three unexcused absences may be assigned a grade of WF for the course. Students are responsible for acquiring any missed notes and assignments.

Tutoring: All students are encouraged to attend my weekly Office Hours and the evening student-run Math Lab for help with homework and studying. Even if you do not have a specific question about the material, come by and work on your homework free from distractions and with math experts nearby to help. When you come, make sure you have both your notebook and textbook with you, and that you have at least attempted the problems and/or tried to read the relevant section of your textbook. The primary goal of tutoring is to help you figure out the answers for yourself, not to give you the answer, but if you get stuck, please speak up, even if a Math Lab proctor or myself are helping another student.

Tentative Schedule

Week 1 – Aug 12-16

- The Real Numbers
- Sets and Functions

Week 2 – Aug 19-23

- 1.3 Cardinality
- 1.4 Methods of Proof

Week 3 – Aug 26-30

- 2.1 Convergence
- 2.2 Limit Theorems

Week 4 – Sept 3-6 (9/02 is Labor Day holiday; 9/06 is 1st grade posting)

- 2.4 Cauchy Sequences

Week 5 – Sept 9-13

- 2.5 Supremum and Infimum
- 2.6 The Bolzano-Weierstrass Theorem

Week 6 – Sept 16-18 (9/19-20 is Fall Break)

- 3.1 Continuity
- 3.2 Continuous Functions on Closed Intervals

Week 7 – Sept 23-27 (9/27 is 2nd grade posting)

- 3.3 The Riemann Integral
- 4.1 Differentiable Functions

Week 8 – Sept 30-Oct 4

- 4.2 The Fundamental Theorem of Calculus

Week 9 – Oct 7-11

- 4.3 Taylor's Theorem

Week 10 – Oct 14-18 (10/18 is 3rd grade posting)

- 4.5 Inverse Functions

Week 11 – Oct 21-24

Final Exams Oct 25-30

ASMS Policies and Procedures:

ASMS Mission Statement

The mission of the Alabama School of Mathematics and Science (ASMS) is to provide academically motivated Alabama students with exceptional preparation in the fields of math and science, empowering them to improve their community, state, and nation.

ASMS Honor Code

Every student shall be honor bound not to cheat (including plagiarizing), steal, or disrespect the property of others, or lie about anything pertaining to the school. Any student found guilty of an honor violation will face sanctions up to and possibly including expulsion. Actively aiding someone in breaking the Honor Code is a violation and will be punished as such.

ASMS Honor Pledge

As a member of the ASMS Community, I resolve to uphold the Honor Code of this school. I pledge that what I say and do will be in accordance with this code.

ASMS Absence and Tardy Policy

Class attendance is an integral component of academic success, therefore students must be in attendance to take full advantage of the academic opportunities offered at ASMS. Absences or tardiness can have a substantial impact on a student's academic performance and should be kept to a minimum. Absences from class will be classified as either excused or unexcused.

Attendance Records: faculty are responsible for keeping attendance records of students in their classes and for expressing the ASMS attendance policy in their course syllabi. To ensure accuracy of attendance record keeping, the school nurse will post a daily record of medical excused absences and the nurse or the Director of Student Affairs will post non-academic administrative excused absences.

Unexcused Absences: Unexcused absences will be closely monitored and corrected with the below disciplinary actions. Unexcused absences carry over from course to course and from one term to the next.

Consequences for Unexcused absences (See also Disciplinary Procedures)

1st Absence: Suspension of walk off privileges (1 week) with parent notification

2nd Absence: Saturday School (4 hours) with parent notification

3rd Absence: In dorm restriction (3 days) with parent notification

4th Absence: In dorm restriction (5 days) with parent notification

5th Absence: Referral to Discipline committee as a major infraction which could lead to dismissal from school

Tardiness: Students are expected to be on time for all classes. Tardiness of more than fifteen (15) minutes to one class meeting may be counted as an unexcused absence. Leaving class for more than ten (10) minutes may be counted as an unexcused absence. Students will consult with the course syllabi to determine an instructor's expectations with respect to tardiness. Tardies are cumulative across all courses taken in one term, but do not roll over. Consequences acquired in one term will be resolved regardless of term in which consequences were acquired.

Consequences for Tardiness (See also Disciplinary Procedures):

1st Tardy: Administrative warning and parent notification

2nd Tardy: Two (2) hours extra work service with parent notification

3rd Tardy: Suspension of walk off privileges (1 week) with parent notification
4th Tardy: Saturday School (4 hours) with parent notification
5th Tardy: In dorm restriction (3 days) with parent notification
6th Tardy: Referral to Discipline committee as a major infraction which could lead to dismissal from school

Excused Absences: When a student needs to be absent from class for an excusable reason, it is the responsibility of the student and parent to follow proper protocol to inform the school of the requested absence. Parents are asked to schedule family activities, medical appointments, college visits after school hours or during school breaks. It is the responsibility of the student to obtain assignments prior to their absence and make up any work during their absence. Circumstances may arise where exceptions are appropriate, however every effort should be made to limit class absences for any reason.

Illness on Campus: Students who will need to miss class due to illness must report to the nurse's office. To be excused from a first period class, the student must report to the nurse by 7:45 a.m. If the nurse cannot substantiate the student's claim of illness, the student will be expected to attend class. To be excused from all other classes during the day, the student must report to the nurse's office 30 minutes prior to start of the class period. In the event a student is placed on room restriction due to an excused illness, the following procedure will be implemented.

Medical Room Restriction Procedure:

1. Nurse or Hall staff implements room restriction due to medical reasons.
2. Student will stay in their dorm room until the next a.m.
3. Food may be obtained from the cafeteria in a takeout box during meal times and the student will go back to their room.
4. Bathroom breaks are allowed during Room Restriction.
5. After school activities are not allowed and the student is to remain in their dorm room.
6. If a student needs medical attention, they will call the front desk and ask to be transferred to the nurse's office.
7. If a student needs medical attention after hours, they may summon the lead hall advisor through another student or call the front desk and ask for the lead hall advisor.

Illness Off Campus: Students who become ill while at home for a weekend or a break should not return to campus until they are well and able to attend classes. It is the responsibility of the parent or guardian to report their child's health status to Student Affairs before 6:00 p.m. on Sunday night (251-441-2100).

Absences Requiring Prior Permission: When a student will be absent from a class for an excusable reason (excluding illness, medical emergency or unexplained circumstances), students must submit the proper absence request form to faculty for authorization of the excused absence. This excused absence request form must be submitted at least one (1) class meeting prior to the anticipated absence. Only the President, faculty and medical personnel have authority to excuse a student's absence from class.

- **Pink Form:** Excused absence for personal reasons (see Student Affairs Office)
- **Blue Form:** Excused absence for class field trip (see President's Office)

College Visitors to Campus: Students must obtain prior approval from their instructors to attend a college meeting. The student must also sign up in advance in the College Visit Log

Book located in Student Affairs. Students are excused from class to attend college representative meetings on campus but may not miss a previously scheduled exam to do so.

College Visits: Senior students taking an official college visit must submit the proper absence form at least one (1) week in advance, notify their teachers, and bring proof of the visit which may include college letterhead listing the dates a student visited the campus. Sophomore and junior students should schedule college visits during long weekends or breaks.

Excessive Absences: Whether excused or unexcused, excessive absences have a detrimental effect on a student's academic standing. Accruing (3) three unexcused absences in a course may be cause for a faculty member to assign the grade of WF for that course. Accruing five (5) or more total absences, excused and unexcused, will prompt an Administrative assessment to ascertain the reason(s) behind the excessive absences. A determination may result in a recommendation of dismissal from school or a plan of action.

Long Term Absence: The following are guidelines to be followed by the administration in dealing with situations where a student is absent from ASMS for long periods due to illness.

Assessment: On the 5th consecutive day of absence from all classes, an assessment will be conducted by the Director of Student Affairs. Parents will be contacted, and doctors' opinions will be sought, if necessary. Questions that will likely be pertinent are: What is the nature of the illness? How much time will elapse before the student will be capable of working up to full capacity? Is the student capable of doing any work at all at this time?

As a result of the assessment several scenarios are likely.

- If the student is capable of some work at home, he/she may be able to return to ASMS as a full-time student.
- If the student is not capable of some work at home immediately following the Assessment, the maximum time the student can be out and return to a full load assignment is one additional week after the assessment.
- If the student can return to ASMS and carry a partial load within two weeks after the assessment, the student will be placed on a light load for the remainder of the quarter.
- If the student is capable of some work at home after the assessment and returns to ASMS within two weeks of the assessment to a partial load assignment, he/she will be given an independent study when he/she is capable of a larger load, up to the end of the 7th week.
- If the student will not be able to return to ASMS and carry a full load within two weeks of the assessment, it will not be possible for that student to return to ASMS full-time that quarter. (This amounts to a three-week absence.)

When a student cannot return to ASMS in any given quarter, the situation will be reviewed to ascertain whether the student will be able to return to ASMS in a subsequent quarter and still complete the requirements for an ASMS graduation diploma.

ASMS Grading Policy

Grading follows a letter evaluation system:

A	100-90	Excellent and Passing
B	89-80	Good and Passing
C	79-70	Satisfactory and Passing
D	69-60	Below Average and Failing

F	59-0	Poor and Failing
P		Passing
S		Satisfactory (an interim grade)
I		Incomplete
WP		Withdraw Passing
WF		Withdraw Failing
AUD		Audit
R		Repeat

Academic Integrity

Academic integrity is essential because dishonest behavior undermines student learning and the credibility of ASMS. High standards of academic integrity safeguard a student's reputation, reflect well on ASMS, and contribute to the well-being of society. Conversely, breaches of academic integrity diminish students, school, and public trust in academic endeavors.

While at ASMS, students belong to an academic community and have responsibilities to that community. Upholding these responsibilities maintains the high regard in which ASMS qualifications are held and fosters public support for educational ideals and ASMS.

Students should be proud of the high standards of academic integrity for which we strive. Society flourishes when high standards of integrity are evident.

ASMS students are expected to maintain high levels of integrity in all of their academic pursuits. Cheating of any kind (on any exam, quiz, lab, tests, homework, or any other type of assignment), as well as plagiarism of thoughts, words, or ideas are prohibited. Students who engage in academic dishonesty will be dealt with in accordance with the policies outlined in the Student Code of Conduct.

Cheating is a form of academic dishonesty in which the person misrepresents his or her mastery of the course content. Cheating applies to examinations, labs, written assignments, online discussion, and any other form of student assessment. Examples include but are not limited to the following:

- Using unauthorized materials such as a textbook, prepared notes, study aids, or an electronic device during an examination;
- Unauthorized access to or use of someone else's computer account or computer files to complete an assignment;
- Possessing or obtaining an examination without the instructor's authority or prior knowledge;
- Submission of an assignment purchased from a commercial entity (e.g., term papers, software programs, etc.);
- Unauthorized preprogramming of and/or access to electronic devices; and
- Leaving a classroom or testing area during a test to access information or answers.

Plagiarism is a form of dishonesty by which the person misrepresents someone else's words, ideas, phrases, sentences or data as his or her own or otherwise fails to properly acknowledge the source of such material through complete and accurate citations and reference lists. Both the intentional and unintentional use of another's work constitutes plagiarism. Examples include but are not limited to the following:

- Directly quoting another person's words without the use of quotation marks and/or acknowledging the source;

- Submitting the same written work to fulfill the requirements of more than one course without the explicit permission of the other instructors;
- Paraphrasing, or restating, another person's ideas, opinions, or theories without acknowledging the source; and
- Failing to properly cite an original source when using a secondary source.

Fabrication is a form of dishonesty by which the person deliberately invents or falsifies information or research findings with the intent to deceive. Examples include but are not limited to the following:

- Citing information not taken from the source indicated;
- Citing a source that does not exist;
- Intentionally distorting the meaning or applicability of data;
- Citing sources in a bibliography or reference list that were not used in the project; and
- Misrepresenting or falsifying a résumé for a college application or scholarship.

Collusion is a form of dishonesty involving two or more persons acting in a manner intended to misrepresent individual effort, learning, and/or contributions to course assignments.

- Allowing another student to copy from your work, intentionally or unintentionally;
- Completing an assignment for another student;
- Allowing another student to complete an assignment for you (e.g., asking a student to show you their answers or do some work for you);
- Unauthorized sharing of examination questions and/or answers before or after an examination; and
- Unauthorized collaboration with another person during an examination or other assignment.

Other Examples of Academic Integrity Violations include but are not limited to the following:

- Posting another's work on the internet without that person's permission;
- Unauthorized or inappropriate access to use of another's computer account, email or electronic files;
- Misrepresentation to avoid academic work by fabricating an otherwise justifiable excuse such as illness, injury, accident, personal emergency, etc. to avoid or delay timely submission of academic work, or the taking of an examination, or to request an incomplete or WP in the course;
- Coercing any other person to engage in academic dishonesty or misconduct; and
- Aiding any other person engaged in academic dishonesty or misconduct.

IDF Reports

Approximately halfway through each term, a progress report is issued by teachers for any student with a 50% or greater likelihood of receiving a failing grade (F, D, or U) in a course if student performance continues at the same level. In such instances, a progress report of IDF is recorded (in danger of failing). The instructor also includes a comment with the assessment summarizing the student's performance to date. ASMS can request a phone or on-campus meeting with faculty, staff, parents, and the student. Under some circumstances, ASMS will require an on-campus meeting.

ASMS Title IX Policies

Title IX (Title IX of the Education Amendments of 1972) is a federal law that prohibits discrimination on the basis of sex or gender identity in any federally-funded education program or activity. The law states, "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under

any education program or activity receiving Federal financial assistance” (the United States Department of Justice). Title IX addresses sexual harassment, gender-based discrimination, and sexual violence. Sexual violence includes attempted or completed rape or sexual assault, as well as sexual harassment, stalking, and verbal or physical sexuality-based threats or abuse.

Mandatory Reporting Notice: All ASMS employees are required to report incidents of sexual harassment, discrimination, or sexual misconduct to the Title IX Coordinator or the authorities.

Nondiscrimination Notice

The Alabama School of Mathematics and Science does not discriminate on the basis of race, color, national origin, sex, disability, age, sexual orientation, creed, religion, or veteran status in the administration of employment, educational programs and activities, and admissions. Anyone who claims to have been unlawfully discriminated against due to any ASMS regulation or policy or the official action of any ASMS employee should follow the Alabama School of Mathematics and Science Grievance Procedures (forms and additional information are located in the ASMS Student Community Handbook). Inquiries or complaints may be addressed to Title II and Title IX Coordinator, 1255 Dauphin St., Mobile, AL 36604.

Student Accommodations

It is a privilege, not a right, to attend ASMS. Students have the right to attend a public school in their home county. Accommodations are modifications to conditions that would otherwise cause a student, because of a disability, to be at a disadvantage relative to non-disabled students in their access to ASMS’s programs for students. Reasonable accommodations provide equitable access to programs or facilities and do not fundamentally alter the essential nature of a course or academic program. The Federal Government stipulates that ASMS does not have to grant accommodations when it can demonstrate that making the modifications would fundamentally alter the nature of the service, program, or activity ASMS offers. Because a student has the right to attend a public school in their home county, ASMS will not make accommodations that fundamentally alter the nature of learning or residence life services, programs, or activities. Examples: ASMS will not follow 504 educational plans, IEPs, or requests for additional time for tests and assignments, special access to teacher notes, less homework problems, distraction-free rooms, or the use of calculators or other electronic devices when an instructor bans their use. Moreover, no accommodations will be made to audio or video class lectures or demonstrations.

Student Resources

Students are expected to take full responsibility for their education while attending ASMS. To facilitate academic success, ASMS provides several resources:

- College and career counseling.
- Mental health counseling.
- Study labs associated with courses and subjects.
- Library hours and resources.
- Teacher office hours.