Introduction to Advanced Mathematics
MATH 3100

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Class Website: http://www.auburn.edu/~smith01/math3100Sp26/

Office Hours: 10:00 – 11:00 MWF.

Text: Notes on the class website.

Optional helpful Text: "Introduction to Mathematical Thinking" by Devlin is a helpful source for constructing and writing up proofs.

Grade Calculation

Item	
Presentations and Participation	15%
Writing Assignments	15%
Written Projects	10%
Tests	25%
Final Exam	35%

The standard 10 percentage point scale will be used: 90 to 100 =A; 80 to <90 = B; 70 to < 80 =C; 60 to <70 = D; <60=F.

ACCADEMIC HONESTY: Plagiarism (work presented as your own that is not your own) and giving or receiving aid on exams in whatever form will result in action by the University Honesty Committee. Refer to the Tiger Cub for more specific details.

ABSENCE FROM EXAMS: Refer to the Tiger Cub for a list of acceptable reasons for being absent from an exam, quiz or class. Any absence from the final exam must be cleared with your Dean's office.

Accommodations for Disabilities: Students who require such considerations should make an appointment with me during the first week of classes. They should discuss with me the specifics of their accommodations at this meeting. If you are not sure of your needs or of the accommodations process, it is recommended that you make an appointment with a member of the professional staff in the Office of Accessibility, 1244 Haley Center (844-2096).

Attendance Requirement. Attendance and class participation are a critical part of this course. Students are permitted one unexcused absence. More than one unexcused absence (an excused absence is any University excused absence) will result in percentage points taken off the final grade as follows:

1 missed class results in a total of zero points subtracted,
2 missed classes results in a total of 2 point subtracted,
3 missed classes results in a total of 5 points subtracted,
4 missed classes results in a total of 10 points subtracted,
More than 4 missed classes will result in a grade of "F" assigned for the class.

Writing Enrichment Statement. This is a writing enriched (WE) course, meaning students will have the opportunity to practice and refine their writing skills. Students will be required to complete writing assignments in the field of mathematics; this process is expected to enhance student communication skills and deepen their critical thinking skills.

Class Participation and Working in Groups

Students will be expected to present their written proofs to theorems and solutions to homework exercises on the blackboard (or document camera/whiteboard/…). An integral part of the learning process for any mathematics course is solving mathematics problems. You will be challenged to prove theorems and solve problems that you have not seen. The proofs should be written up for presentation to an audience consisting of your classmates in mind. My purpose is to develop analytical problem-solving techniques that can be applied to a broad range of real-world and abstract problems. Though idealized, the problems assigned for the course mirror problems encountered in higher mathematics, science and engineering disciplines. The techniques of mathematics are retained much more firmly if students can discover their own solutions to problems and write down their solutions carefully in a systematic way in notebooks or journals. Students will be expected to critique other student presentations for understanding and correctness; this is to be done respectfully. Alternate methods of proofs or solving problems also add to one's repertoire of problem-solving techniques; I encourage students to offer presentations of different techniques for problem-solving. Working in groups is not discouraged (and in fact is often encouraged); students are expected to present their own work on the blackboard and to give credit to other students (or any other outside resource) who (that) have contributed to the solution of the problem they are presenting.

Parameters for Working in Groups

It is unethical to use someone else's work as your own; this includes solution given by an AI. In working together, each person should start working on a theorem proof or exercise themselves; if you get stuck at some point you might ask your study group, "did anyone figure this out?" and accept someone's help (and not a completed solution) in

getting over a difficulty. Typically, a new type of problem often needs a "trick" (or more correctly, a new technique) for solution and not everyone will figure out what's needed at the same time. To those who figure out the "trick" - I encourage you to offer hints (this is my own method of helping students) at first rather than offer a complete solution. If one has figured out most of the underlying work for themselves then the new technique - whatever gets us over the hurdle - is more firmly remembered. Finally, as mathematicians do, one should properly give credit to one's collaborators for their contributions. When presenting a collaborative solution, credit for the discovery of a new technique should be given to the individual who figured it out. When assigned projects are handed in, include the names of members of the study group and give credit to those who figured out critical techniques and steps.

Writing Assignments.

MATH 3100 is the mathematics course that contains the "writing in the discipline" component and also has the writing enrichment (WE) designation. Students will be required to learn LaTex; write-up assignments are to be written in LaTex converted into a pdf file and sent via email to me. Typically you will be asked to write up your proof of a theorem or solution of an exercise that you presented to the class plus other theorems of your choice (these will need to be okayed by me). You will have about three class periods to complete the assignment. Always email me the pdf files as an attachment and use the following naming convention: LastName_Discriptive.pdf (e.g. SmithSecondWrite-up.pdf).

Your first writing assignment will be a group project. As indicated above, subsequent writing assignments will be linked to your oral presentations. Thus your argument/proof has already gone through one set of evaluations by me and the class. If you earn less than 90% on the assignment then you are permitted to revise the write-up and make the necessary corrections to improve your grade. By turning in a revised/corrected write-up you can earn additional points up to half the points lost up to a maximum of 90%.

Correct grammar, punctuation and spelling are important (add all the new mathematical terms to your dictionary!) All sentences must have a subject and a verb; most also have an object. In mathematical writing an equation is a sentence:

$$x + y < \sqrt{a^2 + b^2}.$$

In this sentence, "$x + y$" is the subject;
"$<$" is the verb;
"$\sqrt{a^2 + b^2}$" is the object.
Note the punctuation of the period.

In a similar way to writing poetry, a good written mathematical argument is not dependent on its length.

The process: Students are required to learn LaTex and use it to write-up their assigned theorems or exercises. For the most part (except the first one which is a group project where the students are first learning LaTex) writing assignments are linked to the student's oral presentations. The student is asked to write up a proof or solution to an exercise that they wrote up in their notes and presented in class. Thus the student's proof has already gone through one set of evaluations by me (and by the class in the form in which they indicate their understandings by questions.)

If a student earns less than a 90% then they are permitted to revise their write-up based on my comments and make the necessary corrections. Typically, if they do a good job, this resubmission would raise their grade to the lower of 90% or to their original grade plus half the lost points.

Projects.

There will be some major writing projects. These will include writing up the proofs of major theorems and/or writing up the solutions to an extensive interrelated set of exercises. The writing rubrics apply here as well.

Presentations.

Students are called to present their written proofs of theorems or solutions to exercises in front of the class. I record a checkmark and use √, √+, √+ +, √-, √-- in my presentation grade sheets. I use check plus for excellent, check for medium/good, check minus for poor but with some indication that the student understood some of the mathematics, check double minus when there is no indication that the student has made any progress on the exercise. If a student makes a major mathematical mistake, I generally give them the opportunity to correct their work for the next class for full credit. So a student who makes a major mathematical mistake can correct it and still receive an A presentation grade. Also, I give students opportunities to get extra presentation points by volunteering to present an extra theorem or exercise. These two factors allow most of the conscientious students to get close to 100 % for their presentation grades, and even some over 100 % for doing extra problems. I feel that this encourages the students to work hard on their presentations.

In terms of time, 6 to 7 minutes for a presentation is probably closer to the minimum – some have gone as much at 15 minutes depending on the difficulty of the problem and the questions from the class (and from me). Depending on the size of the class I can get in from 6 to 10 presentations in a semester. I use a (pseudo) random number generator to select the order for the roll that I use with which the students are called to present.

Appendix 1: Grading Rubric for written assignments.

Following it the grading rubric I use:

Excellent: An excellent write-up (90 – 100 but I round up so some high 80's are here) is one where:

1. The mathematics is correct and there are only a few grammatical or stylistic problems.

2. The write-up of the proof or exercise would be understandable to other members of the class, the proof has all the needed details and is logically correct.

Good: A good presentation (graded as 70's & 80's) is one where:

The mathematics is for the most part correct but the student makes some errors; I have to explain the error. But the underlying idea is okay and the student is able to express that idea.

Poor: A poor but passing presentation (60's) is one where:

1. The student uses some correct techniques, but does not have a correct explanation of the steps needed toward the solution.

2. The student may have the "answer" but does not have a correct explanation of the reasoning.

3. The student makes logic errors.

Failing: A failing write-up (below 60) is one where the student does not have the mathematics correct and has little understanding of the logic behind the proof. Also in this category are grades given to students who fail to hand in their assignments.

Appendix 2: Oral Presentation Rubric.

Students are called to present their proofs of theorems or solutions to exercises in front of the class. I record a checkmark and use √, √+, √+ +, √-, √-- in my presentation grade sheets.

√+, √+ + (Outstanding) An outstanding presentation (converted to 95% – 100% for the purposes of grades) is one where:

1. The mathematics is correct baring some minor errors (and these errors are corrected at the board after questions from me or the class).

2. The presentation is understood by the class – essentially this means that all their questions are adequately addressed (in practice this means that the attentive student can solve a similar problem to the one presented. (I will often ask the class, or someone in the class, to justify some particular step based on the presentation to make sure they understand.)

3. The student can adequately address my questions.

4. The student may receive a check plus if the problem is especially hard or challenging, or the student use a particularly imaginative way of approaching the problem.

√ : (Excellent) An excellent presentation (90% – 95%) is one where

1. The problem uses known techniques or is a (more or less) routine application of the presented course material.

2. The presentation is understood by the class and student is able to justify their steps.

3. The student can adequately address my questions.

4. I may need to add some minor details.

√ (Intermediate) A medium good presentation (85%, 90% for harder problems) is one where:

1. The mathematics is for the most part correct but the student makes some errors; I have to explain some step to the class because the presenter does not adequately do so. But the underlying idea is correct and they are able to present that idea.

2. The class has many questions of understanding; I have to help a little to explain the proof or solution.

3. The student answers most of my questions with a little help (if a student in the class helps then that second student can receive presentation credits as well! If the presentation is such that in spite of the errors, that another student in the class can make the corrections, then the presentation is at the higher end of the B/C range).

√ - (Basic) A basic passing presentation (70 %) is one where:

1. The student uses the correct techniques, but does not have a correct explanation of the steps needed toward the solution.

2. He/she may have the “answer” but doesn’t explain it well enough to the class and I have to redo the problem myself.

3. The student cannot answer my questions well.

√ - - (Little/None). A failing presentation (0% - 65 %, I assign the passing percentage if the student made an attempt to do the problem) is one where the student does not have the mathematics correct and does not indicate any understanding of the problem or is not prepared to present at all.