MTH 311.001 – Fall 2018
Introduction to Modern Mathematics

Course Description
Introduction to logic, basic properties of sets, relations, functions, one-to-one functions, set equivalence, Cantor’s theorem, countable and uncountable sets. A more detailed course description is available online.

Course Prerequisites
MTH 234

Course Time and Meeting Place
- MTH 311 Section 001 meets in Math 205 at 10:00-10:50 MWF

Instructor
- Jane H. Long, Ph.D., Associate Professor, Department of Mathematics and Statistics
- Office: Math 318
- TEL: (936) 468-1804
- Email: longjh@sfasu.edu

Office Hours:

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
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<tbody>
<tr>
<td>Monday</td>
<td>11:00AM – 12:00PM</td>
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<tr>
<td>Tuesday</td>
<td>10:00AM – 11:00AM</td>
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<tr>
<td>Wednesday</td>
<td>11:00AM – 12:00PM</td>
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<td>Thursday</td>
<td>10:00AM – 11:00AM</td>
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<tr>
<td>Friday</td>
<td>11:00AM – 12:00PM</td>
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Additional office hours by appointment.

Course Goals
- To learn to give precise, logical mathematical arguments (proofs) justifying mathematical statements
- To develop abstract thinking skills
- To learn to communicate mathematical ideas precisely

Learning Objectives
At the end of MTH 311, a student who has studied and learned the material should be able to:
1. Read and interpret written mathematics and communicate their reasoning both orally and in written form.
2. Translate between symbolic logic notation and standard English.
3. Understand and interpret compound statements, logical arguments, and fallacies.
4. Make appropriate inferences based on conditional and biconditional statements.
5. Understand the role of quantifiers in mathematical statements.
6. Formulate reasonable conjectures and construct rigorous, well written proofs using a variety of proof techniques (including direct and indirect proofs).
7. Construct appropriate counterexamples to disprove statements.
8. Understand the principle of mathematical induction and use it in the formulation of mathematical proofs.
9. State and use important definitions in set theory.
10. Understand and construct proofs concerning subsets and set equality.
11. Recognize and prove theorems about equivalence relations, including congruence relations on the set of integers.
12. Understand the notion of function and be able to state and use definitions of one-to-one, onto, image and pre-image.
13. Understand the notions of infinite set and cardinality and use them to prove that given sets have the same cardinality.
14. Understand a proof of the uncountability of the set of real numbers.
15. Apply their understanding of logic and proof in an appropriate mathematical context which may include number theory, graph theory, topology, analysis, algebra or other relevant topics.

Students graduating from SFASU with a B.S. Degree and a major in mathematics will display competency in the following areas:
1. **Concepts**: Demonstrate comprehension of core mathematical concepts (notion of theorem, mathematical proof, logical argument)
2. **Skills**: Execute mathematical procedures accurately, appropriately, and efficiently (calculus, algebra, routine, non-routine, applied)
Logical Reasoning: Apply principles of logic to develop and analyze conjectures and proofs (quantifiers, breaking down mathematical statements, counterexamples)

Problem Solving: Demonstrate competence in using various mathematical tools, including technology, to formulate, represent, and solve problems (calculus tools, algebra tools, applied tools, nonstandard problem solving)

Communication: Demonstrate proficiency in communicating mathematics in a format appropriate to expected audiences (written, visual, oral)

Textbooks
The required textbooks for this course are unpublished course notes by Dr. Dana C. Ernst at Northern Arizona University and SFASU faculty. They are freely available and will be provided for download by the instructor.

Course Requirements
- Three in-class exams, tentative dates listed below
- Final Exam (lasting 2 hours), taken Wednesday, December 12, 10:30AM – 12:30PM. There may also be a take-home portion of the final exam which will be due Wednesday, December 12, 10:30AM
- D2L access. You will be required to access SFA’s Learning Management Software (at http://d2l.sfasu.edu) periodically for announcements and access to required course materials
- Access to mathematical typesetting software. You will be required to type and turn in weekly homework assignments. Free CoCalc access, which you may have from previous classes at SFA, will suffice for this purpose. The instructor will provide details
- Homework from the text will be collected, daily and weekly (see below), and graded
- Daily homework. Due in class each day unless otherwise indicated
- Weekly homework. Generally due Mondays at 11:59PM. Must be typed
- Presentations. Daily homework from text will be presented by students and discussed in class. These discussions are the main avenue for learning in this course. Presentations will be graded (see below for more information)
- Exam corrections, in which you rework any exam questions for which you lost credit. Errors should also be classified according to the instructor’s criteria. These assignments will be returned to you for editing until they are completely correct. Credit for this assignment will not be awarded until all errors are completely corrected. These assignments are classified as “homework” and will not alter exam grades. These assignments are for exams I, II, and III only
- Attendance and participation in class are expected. Most of our class time will be spent in student presentations and large class discussions. Learning within this framework requires active participation
- Additional assignments at the instructor’s discretion
- Late work will not be accepted
- There is no extra credit
- Initiative to seek help outside of class may be necessary in order to succeed in the course

Course Calendar (Tentative) See next item for exam dates.
- Logic and Introduction to Mathematical Proof Techniques, August 27 – September 24
- Set Theory and Introduction to Mathematical Induction, September 26 – October 31
- Relations and Functions, October 15 – November 12
- Finite and Infinite Cardinalities, November 14 – December 7
- Other topics as time permits

Per SFA policy 5.4, your schedule should reflect that there is (1) an amount of student work per credit hour that reasonably approximates not less than one hour of class or direct faculty instruction and two hours of out-of-class student work per week for fifteen weeks over a long semester, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

Grading and Exams
The will be three 50 minute exams and a final exam. Your course grade will be determined as follows:
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<tr>
<th>Component</th>
<th>Date</th>
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<tbody>
<tr>
<td>Homework</td>
<td>All work other than exams (daily homework, weekly homework, exam corrections, presentations)</td>
<td>40%</td>
</tr>
<tr>
<td>Exam I</td>
<td>Friday, September 21</td>
<td>20%</td>
</tr>
<tr>
<td>Exam II</td>
<td>Friday, October 12</td>
<td>20%</td>
</tr>
<tr>
<td>Exam III</td>
<td>Friday, November 16</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Wednesday, December 12, 10:30AM-12:30PM</td>
<td>Students earning 85% or above on the final exam will earn one letter grade higher than their semester work average computed on the scale greater than or equal to 90% corresponds to A, greater than or equal to 80% but less than 90% corresponds to B, greater than or equal to 70% but less than 80% corresponds to C, greater than or equal to 60% but less than 70% corresponds to D, and less than 60% corresponds to F. Students earning greater than or equal to 65% but less than 85% on the final exam will earn the letter grade corresponding to their semester work average. Except under extraordinary circumstances, students earning less than 65% on the final exam will earn the letter grade corresponding to their semester average. The maximum letter grade is A and the minimum letter grade is F.</td>
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**Homework**

Homework will also be assigned from the text and graded. Your homework score is based on your grades from daily homework, weekly homework, exam corrections, presentations and any other assignments that are not exams.

You may collaborate with other students in this class but the work you write up and turn in should be your own. Even if you work with a group of students, you should not turn in identical write-ups. Your work should be communicated in your own words.

In addition, you should not consult outside sources (internet, books, other professors, students not in our class, tutors, other human beings, etc.). The most important reason for this is that you rob yourself of a learning opportunity when you look outside of yourself for solutions. Moreover, it will be very apparent during presentations that you do not fully understand important mathematical ideas. In general, students who copy or mimic proofs are unable to transfer ideas to other situations, which becomes obvious on exams and in later courses.

If your work is too similar to that of other student(s), or to outside sources, you should be prepared to be asked to justify your work individually or you may not receive credit for an assignment. This is a tedious and frustrating process for both the instructor and the students, and if it becomes a pattern, the instructor may report the situation as academic dishonesty.

**Grading for Daily Homework**

Problems will be assigned to turn in each class day unless otherwise indicated. Bring a hard copy to class (may be handwritten). Each problem should be prepared on a separate sheet of paper, to allow flexibility as to what is turned in each day. Students will present these problems at the board during class. Based on the in-class discussion, you may annotate your work using special pens provided by the instructor. The work you completed before class is graded on a √-, √, √+ basis; annotations are for your own benefit.

**Grading for Weekly Homework**

Each week, you must select two problems to turn in from a list of problems presented in class the previous week. Your work must be typed and turned in via D2L Dropbox. Free CoCalc access provided by the department will be sufficient to complete the typed work.
<table>
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<tr>
<th>Score</th>
<th>Criteria</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Completely correct, clearly written solution</td>
</tr>
<tr>
<td>3</td>
<td>Mostly correct, minor flaw in mathematical detail or writing</td>
</tr>
<tr>
<td>2</td>
<td>Partially correct, significant flaw(s) or gap(s) in mathematics or significant writing errors</td>
</tr>
<tr>
<td>1</td>
<td>Some progress toward a correct solution</td>
</tr>
<tr>
<td>0</td>
<td>Essentially no progress toward a correct solution</td>
</tr>
</tbody>
</table>

Any problems for which you earned a 1, 2 or 3 may be resubmitted within one week of the date the assignment was returned to you. Your recorded score will be the average of the two grades earned.

**Grading for Presentations**

Daily homework problems will be presented and discussed in class. You should plan to present at least twice prior to each exam. Presentations are graded according to the following scheme:

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<tbody>
<tr>
<td>4</td>
<td>Completely correct solution with clear presentation</td>
</tr>
<tr>
<td>3</td>
<td>Mostly correct, minor flaw(s) in mathematical detail or language</td>
</tr>
<tr>
<td>2</td>
<td>Partially correct, significant flaw(s) or gap(s)</td>
</tr>
<tr>
<td>1</td>
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**The Classroom**

- The format for this course will probably be different from your previous math classes. **Most of the class time will be spent with students presenting problems completed before class.** The class will discuss these problem presentations, and you may use pens provided by the instructor to annotate the work you prepared for class that day – these annotations are essentially your notes for the class. You should not expect that the instructor will lecture, or that you will have a clearly defined set of notes to copy from the board. Instead, you and your classmates will construct your own knowledge with the professor facilitating discussions and asking questions. Getting used to this format requires some time, so be patient with yourself.

- **DO NOT** use your cell phone in class. This especially includes texting. Phones should be set to silent mode and put away during class time. **You will be required to put your cell phone in a basket for the duration of the class period if I see you use it during class.** You may **NOT** use your cell phone as a clock or calculator on exams. Research shows that human brains cannot multitask complex, abstract information with cell phone usage, so this policy is designed for your benefit.

- **Acceptable Student Behavior**
  Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

**Attendance Policy**

- Regular attendance is expected and absolutely necessary for your learning in MTH 311.
• Exam make-ups must be approved **beforehand** with documentation of a valid university sanctioned excuse
• Late homework is not accepted
• Bring your university ID card to all exams
• Arrive on time (early) to class having done all required work for the day
• The university’s Attendance and Excused Absences Policy can be found [online](#)

**Withheld Grades Semester Grades Policy (A-54)**
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

**Students with Disabilities**
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go [online](#)

**Acceptable Student Behavior**
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

*Please be respectful of your fellow students and your instructor. Cell phone use and texting are not allowed in class. Remember to turn your cell phone off or place it in quiet mode before entering the classroom.*

**Academic Integrity (A-9.1)**
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

*Definition of Academic Dishonesty.* Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Any acts of academic dishonesty will be dealt with according to University policy. Penalties for academic dishonesty may result in a failing grade for the assignment, failing the course, or even dismissal from the university. Please read the complete [Academic Integrity Policy](#)

*“Two things are very important: teach joyfully and be strict, and because you want your student to learn the proper thing....”*  
- R. Sharath Jois