Intro to Higher Mathematics

Fall 2015

MTH 300 Section 101, CRN 3083

**M,T,W,R 1:00 – 1:50 SH 509**

**(Revised 8/20/2015)**

# Instructor: Dr. Bonita A. Lawrence

 614 Smith Hall, Differential Analyzer Lab

 696-3040, 696-3854, lawrence@marshall.edu

Office Hours: 2:00 P.M. – 3:30 P.M. T,R

 10:00 A.M. – 11:30 A.M. M,W

 Or a time that we can find that

 works for both of us!

**General University**

**Policies:** By enrolling in this course, you agree to the University Policies presented below. You can read the full text of these important policies online using the following path: Marshall Home Page - Course Catalogs – Undergraduate Catalogs. At this point, choose the catalog you started under (or any catalog after that).

**University Attendance**

 **Policy**: The University Policy that describes excused absences can be found in the Marshall University 2015– 2016 Undergraduate Catalog on pages 85 – 86.

**Academic Dishonesty Policy:** I expect you to do your own work. You can certainly discuss the homework problems with your colleagues but what you present to me for any type of assessment must be your own. The University’s policy concerning academic dishonesty can be found in the Marshall University 2015 – 2016 Undergraduate Catalog on pages 71 - 73.

**Policy for Students with Disabilities:** Marshall University is committed to equal opportunity for all. Students with physical, learning or psychological disabilities should contact the Office of Disabled Students Services (DSS) in Prichard Hall Room 117, 304 696-2271 and provide documentation of their disability. After consultation the DSS coordinator will send a letter to the student’s instructors describing the accommodations the student will need. For more information, go to <http://www.marshall.edu/disabled> or call or visit the office in Prichard Hall.

**Affirmative Action Policy:** In the spirit of equal opportunity for all, Marshall University has an Affirmative Action Policy. This can be found in the Marshall University 2015 – 2016 Undergraduate Catalog on p. 68.

**Inclement Weather Policy:** In the event of bad weather that may prevent us from coming to school, Marshall has a policy that describes how things will be handled. (Note that I have been here for 12 years and we have only shut down school one day during this time.) The policy can be found on pp. 69 -70 of the Marshall University 2015 – 2016 Undergraduate Catalog.

**Course Description from Catalog:** A transition between elementary calculus and higher mathematics with emphasis on techniques of proof. (PR: *C* or better in MTH 230)

**Course Prerequisites:** MTH 230 – Calculus II

In this course our primary goal is to develop your ability to read, with understanding, proofs presented to you and to construct logical and valid proofs of your own. One of area of mathematics we will use as our proving ground will be the theory of functions. Your calculus training will serve as a foundation for these discussions.

**Course Objectives:** This course is designed to develop your skills for proof writing. Mathematics is a collection of axioms, definitions, lemmas, theorems and corollaries that are woven together in a beautiful structure. The development of our mathematics relies on the discovery of new ideas. Such ideas can only become part of the mathematics we use and appreciate if they can be proved using established results. In this course, my primary goals are to teach you to read and understand classical mathematical proofs and to write logical and valid proofs of your own. This can be a fantastic experience that is a bit different than the mathematics courses you are used to and will be very much a creative endeavor.

 I am looking forward to an exciting semester!

Success in the course will be measured by your ability to meet the following learning outcomes.

 The ability to

1. Exhibit an understanding of mathematical logic.

Skill Development: Small group and whole group analysis of

a) compound mathematical statements to determine their truth values, b) the logical structure of classical proofs. Daily exercises with review the following day.

Assessment: Written and oral presentations of a) truth tables and b) proofs of classical theorems.

1. Exhibit an understanding of a variety of proof writing techniques.

Skill Development: Small group and whole group analysis of proofs of propositions (including classical theorems) as well as arguments that fall short of proving a proposition. Daily exercises with review the following day.

Assessment: Written and oral presentations of proofs of propositions that require you to describe the techniques used and how they were applied to the particular proposition. Analyses of arguments that fall short of a valid proof

1. Construct formal proofs of propositions that address concepts discussed during the course of the semester.

Skill Development: Small group and whole group creation of proofs of stated propositions. Daily exercises with review the following day.

Assessment: Written and oral presentations as well as group discussion with peers of various proofs for stated propositions.

1. Present your work clearly and concisely in both written and oral form. Organization and logical flow will be the secrets to success in meeting this objective.

Skill Development: Small group and whole group creation of proofs of stated propositions. Daily exercises with review the following day.

Assessment: All written assignments and oral presentations at the board.

1. Recognize and appreciate various approaches to the same problem.

Skill Development: Small group and whole group discussions with peers of various approaches of proofs.

Assessment: Exercises that require the use of more than one approach to an exercise or proof of a proposition.

**Textbook and**

**Required Materials:** Bridge to Abstract Mathematics

Ralph W. Oberste-Vorth, Aristides Mouzakitis, Bonita A. Lawrence

 Publisher: Mathematical Association of America

I will grade your homework papers and return them to you. I will ask you to collect these papers in a notebook and submit this portfolio at the end of the semester.

**Grading Procedure:** You grade will be calculated using the following percentages:

 Homework Portfolio: 15 %

 Boardwork: 5 %

 Exam I 20%

Exam II 20%

Exam III 20%

 Final Exam: 20 %

There will be four exams during the semester including the final exam, (**Friday, December 11, 12:45 P.M. – 2:45 P.M**.). The dates for the chapter exams can be found in the schedule of events at the end of this document. In the event you are not able to take the exam on the scheduled date because of serious circumstances, (see Undergraduate Catalog, pp. 121 – 122 or Graduate Catalog pp. 47 – 48 for the list of excused absences) please contact me before the scheduled exam time so that we can plan a time for you to take the exam early.

You will be assigned homework in every class period. You will submit your homework at the beginning class. I will not accept late homework. I will return your work and ask you to collect them in a notebook. This portfolio will be collected at the end of the semester.

I will ask to you present some of your fine works of art at the board for my enjoyment as well as that of your peers. This is what I call “Boardwork”. You must visit the board at least **three** times during the semester to get full credit for your boardwork.

Your final grade will be determined using the following scale:

90% - 100% A

80% - 89% B

70% - 79% C

60% - 69% D

0% - 59% F

My best advice (It’s free!) is for you to keep up with your reading and homework assignments.

**Attendance Policy:** I expect you to be in class every day you are physically able. It is your responsibility to determine what you missed in the event you are unable to attend class. Requesting notes from a colleague would be wise. I am happy to give you information about any assignments you missed. If you miss an exam or a deadline for an assignment and your absence is excused (See University Attendance Policy, page 1 of this document), you have one week after the date of the excused absence to make it up.

**Have a great semester and let me know if I can help you.**

**If I can’t answer your question, I’ll find someone who can!**

**Cheers!**

**Dr. Lawrence**

**A Tentative Program of Events for MTH 300**

**Class Days Topics and Events**

**Week 1 A Historical Perspective and the**

**August 24 – 27 Axiomatic Method**

 **Mathematical Statements and Connectives**

**Week 2 Symbolic Logic**

**August 31 – September 3 The Implication Statement**

 **and its Converse, Inverse and**

 **Contrapositive Statements**

 **Loads of truth tables**

 **Boardwork**

**Week 3 Predicates and Quantifiers**

**September 8 - 10 Quantified Statements**

**Direct Proof**

 **(And the Proof Writing Begins…)**

 **Proof Constructions**

 **Boardwork**

 **Exam I - Thursday**

**Week 4 Proof by Contraposition**

**September 14 - 17 Proof by Contradiction**

 **and the Relationship Between the Two**

**The Poof! (not proof)**

 **Loads of Proof Writing**

 **Boardwork**

**Week 5 Proof by Induction**

**September 21 - 24 An Introduction to Set Theory**

**The Art of Chasing Elements**

 **Unions and Intersections**

 **(including arbitrary collections)**

 **Loads of Proof Writing**

 **Boardwork**

**Week 6 Set Difference and Complements**

**September 28 – October 1 Power Sets**

**Proofs of Compound Statements**

**Containing Differences and Complements**

 **Proof, Proof, Proofs…**

 **Boardwork**

**Week 7 Functions and Relations**

**October 5 - 8 Function Codomain and Range**

**The Image of a Set Under a Function f**

**Loads of Examples and Proofs**

 **Boardwork**

 **Exam II**

**Week 8 Injective, Surjective and**

**October 12 - 15 Bijective Functions**

**Composition Functions**

**Loads of Examples and Proofs**

 **Boardwork**

**Week 9 Properties of Compositions Functions**

**October 19 - 22 The Generalized Identity Function**

**The Inverse Function**

**Loads of Examples and Proofs**

 **Boardwork**

**Week 10 Uniqueness of the Inverse Function**

**October 26 -29 The Inverse Image of a Set Under f**

 **and its Relationship to Injective and**

 **Surjective Functions**

 **Loads of Examples and Proofs**

 **Boardwork**

**Week 11 Properties of Relations**

**November 2 - 5 Strict Partial Orderings**

 **Partial Orderings**

**Loads of Examples and Proofs**

**Boardwork**

**Exam III**

**Week 12 Strict Total Ordering**

**November 9 - 12 Total Ordering**

**Maximal Element of a Partial Ordering**

**and Greatest Elements of a Partial**

**Ordering**

**Loads of Examples and Proofs**

 **Boardwork**

**Week 13 The Upper Bound and the**

**November 16 - 19 Least Upper Bound**

**The Concept of a Time Scale**

 **Loads of Examples and Proofs**

 **Boardwork**

**Week 14 Thanksgiving Holiday! Have fun and**

**November 23 - 27 return safely!**

**Week 15 Jump Operators**

**November 30 – Limits and Continuity**

**December 3 Loads of Examples and Proofs**

 **Boardwork**

**Final Exam:**

**Friday, December 11, 12:45 P.M. – 2:45 P.M.**