Intro to Higher Mathematics

Spring 2017

MTH 300 Section 201, CRN 4145

**M, T, W, R 1:00 – 1:50, Smith Hall 509**

**(Revised 1/9/2017)**

# Instructor: Dr. Bonita A. Lawrence

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Office Hours: 10:00 A.M. – 12:00 P.M. T, R

10:00 A.M. – 12:00 P.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. (Prior to last year, during my time at Marshall, the University was only shut down for 1.5 days. However, last spring it was more than a week!) 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 and 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, May 5, 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**

**January 9 - 12 Axiomatic Method**

**Mathematical Statements and Connectives**

**Week 2 Symbolic Logic**

**January 17 - 19 The Implication Statement**

**and its Converse, Inverse and**

**Contrapositive Statements**

**Loads of truth tables**

**Boardwork**

**Week 3 Predicates and Quantifiers**

**January 23 - 26 Quantified Statements**

**Direct Proof**

**(And the Proof Writing Begins…)**

**Proof Constructions**

**Boardwork**

**Exam I - Thursday**

**Week 4 Proof by Contraposition**

**January 30, 31 Proof by Contradiction**

**February 1, 2 and the Relationship Between the Two**

**The Poof! (not proof)**

**Loads of Proof Writing**

**Boardwork**

**Week 5 Proof by Induction**

**February 6 – 9 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**

**February 13 – 16 Power Sets**

**Proofs of Compound Statements**

**Containing Differences and Complements**

**Proof, Proof, Proofs…**

**Boardwork**

**Week 7 Functions and Relations**

**February 20 - 23 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**

**February 27, 28 Bijective Functions**

**March 1, 2 Composition Functions**

**Loads of Examples and Proofs**

**Boardwork**

**Week 9 Properties of Compositions Functions**

**March 6 – 9 The Generalized Identity Function**

**The Inverse Function**

**Loads of Examples and Proofs**

**Boardwork**

**Week 10 Uniqueness of the Inverse Function**

**March 13 - 16 The Inverse Image of a Set Under f**

**and its Relationship to Injective and**

**Surjective Functions**

**Loads of Examples and Proofs**

**Boardwork**

**Week 11 Spring Break**

**March 20 - 24 Enjoy time with your family and friends and come back safely!**

**Week 12 Properties of Relations**

**March 27 – 30 Strict Partial Orderings**

**Partial Orderings**

**Loads of Examples and Proofs**

**Boardwork**

**Exam III**

**Week 13 Strict Total Ordering**

**April 3 – 6 Total Ordering**

**Maximal Element of a Partial Ordering**

**and Greatest Elements of a Partial**

**Ordering**

**Loads of Examples and Proofs**

**Boardwork**

**Week 14 The Upper Bound and the**

**April 10 – 13 Least Upper Bound**

**The Concept of a Time Scale**

**Loads of Examples and Proofs**

**Boardwork**

**Week 15 Jump Operators**

**April 17 – 20 Limits and Continuity**

**Loads of Examples and Proofs**

**Boardwork**

**Week 16 More cool stuff…**

**April 24 – 27 Boardwork**

**Final Exam:**

**Friday, May 5, 12:45 P.M. – 2:45 P.M.**

University Class Attendance Policy (Approved by the Faculty Senate, Spring 2015)

Students are expected to attend punctually all class meetings, laboratory sessions and field experiences and to participate in all class assignments and activities as described in the Course Syllabus. Absences are counted from the first class meeting after the student registers. Students registering late are expected to make up all missed assignments in a manner determined by the instructor. Students should be aware that excessive absences, whether excused or unexcused, may affect their ability to earn a passing grade. The instructor of each class shall establish a policy on class attendance and make-up work, and provide the policy to students in the Course Syllabus. This policy must not conflict with university policies, including this policy. Class attendance may be a criterion in determining a student’s final grade in the course if the instructor provides a statement to this effect in the course syllabus.

Students must promptly consult with their instructors about all class absences. Instructors will work with students to identify appropriate documentation and discuss any missed class time, tests, or assignments. A student may not be penalized for an excused absence, provided that the student, in a manner determined by the instructor, makes up the work that has been missed.

Instructors are required to honor University Excused Absences and to provide reasonable and equitable means for students to makeup work missed as a result of those absences. Academic obligations that cannot be made up should be addressed by the course instructor in consultation with the student to ensure that continued enrollment is feasible while there is still an opportunity to drop the course within the established withdrawal period.

This policy excludes academic endeavors that require the completion of a specific number of clock hours, such as clinical experiences, practica, and internships. For those courses, the department chair or program supervisor will determine the maximum number of absences. This policy does not supersede program accreditation requirements.

This policy also excludes laboratory courses that require significant preparation and monitoring. For such courses, departments will determine the minimum number of laboratories a student must complete to pass the course. If a student cannot complete this number of labs, the instructor may recommend that the student withdraw from the class.

If the instructor believes that the number of absences accrued under the terms of this policy (whether excused or unexcused) is such that a student cannot fulfill the learning experience and mastery that a course requires, the instructor may recommend that the student withdraw from the class.