MATH 301 FUNDAMENTALS OF MATHEMATICS FALL 2014

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OFFICE: 221 Herak
OFFICE HOURS: MWF 9-10, Th 3-4, F 1-2 in the Math Lab (Herak 224), and by appointment
TEXTBOOK: *The Book of Proof* by Richard Hammack (available for free online)
WEB SITE: http://web02.gonzaga.edu/faculty/axon/301

Fundamentals of Mathematics covers standard proof techniques through the examination of logic, set theory, the topology of the real line, and the basic theory of functions. Additional topics may be chosen from analysis, algebra, number theory, or combinatorics.

GOALS: In contrast to prior math classes, Fundamentals of Mathematics does not aim to teach a specific branch of mathematics (like calculus or geometry), but instead focuses on the logical skills fundamental to all mathematics. The primary goal of the class is for you to learn to write and understand mathematical proofs. This entails understanding basic propositional and predicate logic and axiomatic systems, the ability to formulate mathematical arguments, the clear expression of such arguments, and the analysis and critique of mathematical arguments. Most of these skills are fundamental to all arguments, not just mathematics, and you will occasionally be asked to apply these skills to non-mathematical situations.

A subsidiary goal for the class is building familiarity with the fundamental objects of formal mathematics: sets, relations, functions, numbers, etc. Proofs need to be about something, and in this class most proofs will be about these objects.

COURSE WORK: New material will be introduced in class (either in lectures or worksheets) or in assigned readings of the textbook (yes, you are expected to *read the book*). Reading mathematics is usually hard work–if it's not, then you might be doing it wrong. Take your time, think about what has already been covered, recall relevant examples, think about how the new ideas apply to those examples, read any provided examples carefully, re-evaluate your own thinking, then go on to the next sentence.

As always, "doing math" requires practice; homework sets are where you will get that practice. Working with other students is encouraged, but submitted work should reflect your understanding of the solution: it's okay to have someone explain their solution to you, but you should make sure you understand it and express it in your own words. Homework will be collected approximately weekly and late work will not be accepted unless permission is obtained in advance. Every effort will be made to grade and return homework in a timely manner and you are expected to review graded homework carefully. Comments and suggestions on specific problems will be an important way for you to learn from your mistakes. You will also have a chance to revisit certain challenging problems in portfolios (which are described below).

Exams are primarily a way to measure student progress in the class. However, studying for exams gives you a chance to review material and understand it with context of later topics. Students often find that they understand difficult topics much better after reviewing for an exam. The word "review" may be misleading: scientific work on learning has shown that merely re-reading the book and notes does not help most students learn. A much better tactic is to review small sections, then think about which problems dealt with the topics covered, solve those problems again, then identify and solve similar problems. Exam questions will require you to write proofs and the best way to prepare for the exam is to practice writing proofs.

GRADES: Grades will be based on exams (50%), homework (34%), portfolios (8%), and worksheets/in-class activities (8%). There will be 2 exams during the semester (with the lower score worth 10% and the higher score worth 15%) as well as a final exam (worth 25%). No extra credit will be given. Final grades will be assigned using the following rough scale (with plus and the top and minus at the bottom of each interval, as appropriate):

Score	Grade
90-100	A
80-90	B
70-80	C
60-70	D
0-60	F

PORTFOLIO: You will be required to make a portfolio showing your progress over the course of the semester. The portfolio will consist of 8 entries, each based on a problem (from a homework set, worksheet, or exam) which was difficult for you. In most cases this should mean that your initial solution was incorrect because of a conceptual error, not just a simple computational error. Each entry should have your original solution, an explanation of what was wrong with that solution, and a correct solution. Two entries are due before the first exam, three more are due before the next exam, and another three are due at the end of finals week.

GUIDELINES FOR WRITTEN SOLUTIONS: You should strive for clarity and, usually, brevity. Start with a clear statement of the problem and, for complex solutions, a brief statement of the main idea or technique of the solution (e.g. "direct proof", "proof of the contrapositive", "proof by contradiction", or "proof by induction"). Avoid introducing superfluous variables and be sure to specify what each variable is when it is introduced. Unless directed to do otherwise, *use actual English words (not just math) to make actual English sentences.*

ATTENDANCE AND OTHER CLASS BUSINESS: Students are expected to attend and participate in all classes. Absences should be excused by the professor in advance or by a written, signed note from an authority. Excessive absences may result in the student receiving a grade of V. Students with disabilities should work with the DREAM office to make sure that all necessary accommodations are made. Any changes to these policies will be announced in class.