Department of Mathematics & Statistics
Concordia University

MAST 217
Introduction to Mathematical Thinking
Winter 2017

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Class Schedule: Tuesday-Thursday, 11:45-13:00 in H 605, SGW Campus.

Office Hours: Tuesdays, Thursdays, 15:00-16:00.

Course Objectives: This course is meant primarily for students who intend to pursue some concentration in mathematics or statistics at the university level.

University-level mathematics courses tend to be somewhat theoretical, and they require the use of a particular language and style that is not familiar to many students. In our experience, students often find it difficult to know what the "rules of the game" are: why all these proofs? What is it that one is expected to know about proofs? How much emphasis should you put on the "how to do things" rather than on the "why something is true"?

MAST 217: Introduction to Mathematical Thinking, aims to address the above questions and to lay a foundation which will help you in all of the mathematics courses which you take at university. We hope to let you in on some of the "tools of the trade" of the mathematician. The topics that we will be discussing include: how proofs work, different styles of proof, the difference between mathematical and everyday language and logic, the roles of examples and counter-examples, the transition from the finite to the infinite, and different techniques of problem solving. MAST 217 is not designed to teach you a lot of new mathematical content (although there will be some new material in the course that you will be responsible for). Most of the mathematics that will be used to illustrate the above topics will be based on familiar material regarding the number systems you already know (e.g. the real numbers), geometry, and functions, and this material will be re-discussed in class to the extent that it is needed.

Text:

The main text for this course is a set of MAST 217 lecture notes by Dr. J. Hillel and Dr. W. Byers which can be purchased at the Concordia Book Store.

The following text is also recommended:
Chartrand, G., Polimeni, A. and Zhang, P., "Mathematical Proofs: A transition to Advanced Mathematics", 3rd ed., Pearson

Other useful texts which can be used as references include:

- Watkins, M. E. and Meyer, J. L., "*Passage to abstract mathematics*", Addison-Wesley.
- Solow, D., *"How to read and do proofs. An introduction to mathematical thought processes"*, Wiley & Sons.
- D'Angelo J.P. and West D.B., *"Mathematical Thinking, Problem Solving and Proofs"*, Prentice Hall.
- Eisenberg, M., *"The Mathematical Method, A Transition to Advanced Mathematics"*, Prentice-Hall.
- Galovich, S., *"Doing mathematics – an introduction to proofs and problem solving"*, Saunders College Publishing.
- Sundstrom, T., "*Mathematical Reasoning: Writing and Proof*", 2nd ed., Pearson

Grading:

The following grading scheme will be used:

- 10 homework assignments: 20%
- One midterm test in approximately the 8th week of classes: 20%
- Final examination: 60%

(Note: There is no "100% final option" in this course. It is absolutely necessary to do the assignments and to take the mid-term test).

List of topics:

Basic tools of mathematical argumentation
- The language of mathematics
- The logical structure of mathematical statements
- Direct proofs and proofs by contrapositive
- Proofs by contradiction
- Proofs by Mathematical Induction

These tools will be practiced in various mathematical contexts:
- Numbers: natural, rational and real.
- Functions.
- Sets and their cardinality; countable and uncountable sets.