Course Syllabus: Math 2000B
Mathematical Concepts
Department of Mathematics and Computer Science
University of Lethbridge, Spring 2015

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Office: UHall C530 **Course website:** via moodle.uleth.ca
Office hours: MWF 11:30 am - 12:30 pm, TR 1:00 - 2:00 pm, or by appointment.
Lectures: Tuesday & Thursday, 3:05-4:20 pm in UHall C674
Tutorial: Monday, 9:00 am (Tut 01), 10:00 am (Tut 02), 11:00 am (Tut 03) in B756
Tutorial instructor: Jeff Bleaney

Course Description

This course can be viewed as a "math as a second language" course. It introduces basic concepts such as logic, set theory, and techniques of proof that form the foundation of mathematics. The course acts as a bridge between computational courses like calculus, and later theoretical courses, like analysis and number theory.

Course Objectives

The main goal in this course is to develop the ability to learn to write proofs and form mathematical arguments. We want to make the transition from *using* mathematics – for example, computing a derivative using established rules – and *doing* mathematics – establishing those rules in the first place, and explaining why they're valid. You will learn the precise logical meaning of words like 'and', 'or', and 'if', and why a precise meaning is necessary. While we will be stressing the importance of proper syntax, the primary focus will be on learning to produce writing that is clear and concise, and easily understood by the rest of your classmates. Even if you are not planning to continue to higher-level mathematics courses, this course should prepare you for any situation where clear technical writing or convincing arguments are needed.

Required Textbook:

Mathematical Reasoning – Writing and Proof, Version 2.0, by Ted Sundstrom. The book is available online for free at https://sites.google.com/site/mathematicalreasoning3ed/. Please see the course Moodle page for details on how to obtain a hard copy. There is also a YouTube channel with recorded lectures for the textbook, at
https://www.youtube.com/playlist?list=PL2419488168AE7001.
Note: It's useful to keep in mind that the topics discussed in this course are common topics central to most mathematics, which means that finding additional resources is not difficult. If you find that you need additional material beyond what's in the textbook, and don't want to head all the way to the library, Google and Wikipedia will be your friends in this course.

Evaluation

Your grade will be determined according to the following table (see below for explanations of each component):

Component	Quizzes	Assignments	Midterm	Final
Weight	25	10	25	40

Quizzes:

Quizzes will be held in the last 20 minutes of every Thursday lecture (except for the week of the midterm) and will be based on problems assigned the week before. Your quiz grade will be based on the **best 10 out of 12** quiz grades. Note that **no makeup quizzes will be given**.

Assignments:

There will be two written assignments, each worth 5%. These will involve written responses, in paragraph form, to several problems. (Contrary to how it is presented in high school, mathematics is primarily a written discipline, consisting mainly of complete sentences arranged in paragraph form, with symbolic notation used only where necessary.)

Participation:

Class participation is encouraged, but not required. We will have a class discussion forum at piazza.com available through Moodle for online participation. Piazza is a Q & A forum that supports mathematical notation and allows you to post anonymously, in case you're worried about posting a bad question or wrong answer.

Notes:

1. The best way to learn how to write mathematics (and proofs, in particular) is to discuss the material with other students (or me). The online forum is a good place to get quick feedback on whether your attempt at a proof is a good one. (A good proof has to be logically sound, and written clearly enough that others can follow your logic.)

2. I'll reward *significant participation* (at least one contribution – question or answer – per week on average) by letting you skip one of the two assignments and take 5% instead.

Midterm:

There will one in-class midterm, written on **Tuesday, the 3$^{\text{rd}}$ of March**. The midterm will cover all material covered prior to reading week.

Letter grade conversions:

The percentage grades earned in this class will be converted to letter grades according to the following table:

Letter grade:	A^+	A	A^-	B^+	B	B^-	C^+	C	C^-	D^+	D	F
Minimum % required:	95	85	80	77	73	70	67	63	60	55	50	0

Course policies

Communication:

Communication between students and myself can take place in several ways:

- Announcements on Moodle. Any updates and reminders will be posted on Moodle. These announcements will be sent to your uleth.ca email address by default, so be sure to monitor that account. It is also highly recommended that you log into Moodle on a regular basis to keep up to date on the course.
- In person, during office hours. (Recommended, especially if you are having trouble with a concept.)
- Online discussion forum, via Piazza.com. (This can also be used to earn participation credit; see below for details.)
- Email. You are welcome to email me with questions about the course, and I will do my best to answer as soon as I can. I do, however, have a few email etiquette rules:
  - Include the course number in your subject heading, and your full name in the message text. Since I teach several classes at once, this will help to ensure a prompt reply. (For example, if your email consists only of "Yo prof, when's the test?" I won't be able to give you an answer since my courses have tests at different times.)
  - Questions about how to solve a particular homework problem should be directed to the discussion forum rather than email: the discussion forum can properly display math symbols, and it's usually the case that several students will have the same question.
  - Questions that can be answered by reading this syllabus (e.g. "When's the test?") will usually not be answered in a timely fashion, and the replies will generally be grumpy/sarcastic in nature.

Homework:

Our textbook is designed for active learning: every section begins with a "preview activity" and includes additional exercises and "concept checks". When reading the textbook you should have a pencil and paper handy to work through problems as they occur. After reading a section in the textbook, you should watch the corresponding screencasts on the textbook YouTube channel. I'll maintain a weekly list of topics on Moodle to keep you advised of which sections to read, and which exercises to work on. The questions on the weekly quizzes will be based on the exercises at the end of each textbook section.

Lecture:

Lectures will be a combination of individual and group problem solving, and review of the material covered in the textbook and screencasts. I will give a lecture for part of each class and address any questions that you have, but classes will be most effective for those students who arrive having done the assigned reading and homework.

Tutorials:

You will be assigned to one of three tutorial sections that meets once every Monday. Your tutorial instructor is Jeff Bleaney. Please note that these are *mixed* tutorials: they consist of students from both lecture sections (A and B) of Math 2000. Note, however, that although the two lecture sections have shared tutorials, they are **independent** classes, with their own priorities and evaluation schemes. At times the two sections will be covering different material in class.

Special arrangements:

If you are a student who has registered for accommodations with the Accommodated Learning Centre, please ensure that I am informed of the necessary arrangements as soon as possible, and please feel free to meet with me if there are any adjustments I can make to improve your learning experience.

Academic honesty:

Students are expected to be familiar with, and abide by, the rules laid out in the Academic Calendar regarding academic honesty, cheating, etc. and the penalties assessed for disregarding those rules.

Tentative course schedule

I will follow the schedule below as closely as possible, although we may at times find ourselves slightly ahead of or behind the planned schedule. Please use the schedule as a guide to plan your readings and exercises.

Date	Topic	Assigned Reading
January 8th	Introduction	Ch. 1
January 13th	Symbolic logic	§2.1, 2.2
January 15th	Logical equivalence	§2.2, 2.3
January 20th	Predicates and quantifiers	§2.3, 2.4
January 22nd	Proving conditional statements	§3.1, 3.2
January 27th	Proof by contradiction	§3.3
January 29th	Proof by cases, congruence	§3.4, 3.5
February 3rd	Division algorithm	§3.5
February 5th	Proof by induction	§4.1
February 10th	Other methods of induction	§4.2
February 12th	Recursion and sequences	§4.3
February 17th - 21st: Reading week – no classes		
February 24th	Sets and set operations	§5.1
February 26th	Proving set relationships	§5.2 5.3
March 3rd	MIDTERM	Covers Ch. 1-4
March 5th	Cartesian products	§5.4
March 10th	Arbitrary unions and intersections	§5.5
March 12th	Functions	§6.1, 6.2
March 17th	One-to-one and onto functions	§6.3
March 19th	Composition of functions	§6.4
March 24th	Inverse functions	§6.5
March 26th	Images and preimages	§6.6
March 31st	Relations	§7.1
April 2nd	Equivalence relations	§7.2, 7.3
April 7th	Modular arithmetic	§7.4
April 9th	Cardinality of finite sets	§9.1
April 14th	Countable sets	§9.2
April 16th	Uncountable sets	§9.3