Math 1200: Problems, Conjectures and Proofs - Fall 2019 - Section A - Zabrocki

Contact information:

Mike Zabrocki
Office: DB (TEL) 2026
Course: FC 202 from 10am-11:15am on Tues/Thurs
Tutorials: Ross S105 and MC 111 from 10:30am-11:20am on Wed
office hours: Monday 11-1pm and Thursday 1-2pm and by appointment

Course description:

Extended exploration of elementary problems leading to conjectures, partial solutions, revisions, and convincing reasoning, and hence to proofs. Emphasis on problem solving, reasoning, and proving. Regular participation is required. Prerequisite: 12U Advanced Functions (MHF4U) or Advanced Functions and Introductory Calculus (MCB4U). NCR note: Not open to any student who is taking or has passed a MATH course at the 3000 level or higher.

Most High School mathematics problems are solved using algorithmic methods or via reference to model solutions. One purpose of this course is to enable students to develop the confidence and ability to attack richer and more demanding problems. The attempt to check work and to explain one's discoveries to others leads naturally to the need for explanation. Learning how to present convincing reasoning — or proof — is one of the course outcomes.

With an emphasis on communication/convincing argument, there is a critical contribution to be made by: group work, reading a proposed 'proof' including other student's work, presenting and discussing as a whole class. There is also value in working through several different approaches to solve a problem, and taking the time to understand an alternative approach offered by a peer in the class. Doing mathematics well includes talking and listening to mathematics and there will be assignments that require collaborative work with another student in the class, as well as support for forming study groups.

The main goal of this course is to develop skills that lead to understanding and communicating a convincing argument. Support will be given for proof presentation, especially for the kinds of proofs that students are expected to produce in their second year and higher level courses. This includes induction, and arguments with counting and with inequalities. Formal proof writing exercises will be introduced in the second half of the course, once problem solving and informal justification skills reach an acceptable level.

Class and tutorial attendance is mandatory and active participation is expected of all students.

Course references:

The course textbook is
Martin Liebeck, A Concise Introduction to Pure Mathematics, Third Edition.
It is recommended, but not required. We will plan to cover the following topics from that text: 4. Inequalities

5. n^th roots and rational powers
6. complex numbers
8. induction
10. the integers
11. prime factoriziation
13. congruences of integers
16. counting and choosing
21. Infinity

Other useful references are

Mathematical Reasoning: Writing and Proof (https://www.tedsundstrom.com/mathematical-reasoning-writing-and-proof) by Ted Sundstrom.
John Mason, Leone Burton, Kaye Stacey, Thinking Mathematically, Second Edition. This book gives an approach to problem solving and the problem solving experience. It is also a source for rich and varied problems.
G. Polya, How to Solve It: A New Aspect of Mathematical Method.

Course components:

The evaluation will be based on the following criteria

Tutorial presentations	based on attendance and in class assignments	10%
Assignments	assigned throughout the term	35%
Midterm	During December exam period	20%
Final Examination	During April exam period	35%

Do your own work. Don't look for a solution on the web or take one from another student's work unless you already have found your own solution and intend to review another to make a comparison. Work that is not original will be graded accordingly. Presenting someone else's work as your own without proper citation is academic dishonesty. You must cite any internet sources which you have consulted. I recommend that you look carefully at the York University Academic Integrity Tutorial (https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/).

Participation: You are expected to show your commitment to this course and your fellow students by sharing your mathematical knowledge of the material. Attendance at the weekly classes and the tutorials is obligatory. The TAs will be calling on people at random from their class list to show solutions to the problems that you have been working on and they will be grading the presentation and solution of those problems. Non participation in these assignments will result in a lowering of your tutorial presentation grade.

Assignments: There will be roughly one assignment every 2 weeks. Most assignments will require explanation beyond a simple one or two word/numerical answer. It is good practice to RECOPY THE QUESTION EVERY SINGLE TIME when you do the assignment. This makes it possible to understand what the assignment when it is handed back to you and it attempts to reduce the error of answering a different question than is on the assignment. Full credit is given to papers which demonstrate deep understanding of the problem by providing multiple solutions and considers variations based on the original question when this is appropriate. Your assignment should include complete sentences and explanations and not just a few equations or numbers. A solution will not receive full credit unless you explain what your answer represents and where it came from. You may discuss the homework with other students in the class, but please write your own solutions.

You should prepare your assignments in LaTeX and hand them in on the online Moodle. LaTeX is a program that was designed for writing mathematics. Information about how to do this is provided on this page (latex.html) and we will discuss it more in class.

Note: Late assignments will be penalized by 10% per day. This will apply to any homework handed in after the class time in which it is due. In addition, assignments which are handed in late are unlikely to be marked in a timely manner.

There are typically two types of assignments that I will ask you do work on for the homework in this class. Sometimes they will consist of smaller problems related to the discussion that we have in class. Other times the assignments will ask you to write and explain a problem

that will require careful analysis and understanding by dividing a long solution into smaller, more manageable steps.

Here is a breakdown of some aspects that I plan to evaluate your solutions. Before you hand in your assignment, I recommend that you read it though carefully and try to address the points from this list.:

(1) The discussion begins with an explanation of the problem
(2) The explanation should convince the reader that the meaning of the question is understood (e.g. small examples, a clearly labeled table of data, and/or a discussion of the meaning of the question)
(3) diagrams, tables or images that are drawn to aid the reader in understanding the problem are well labeled and explained
(4) Clear statements are made of conjectures that are believed to be true
(5) Explanations of why those conjectures are true are included
(6) An explanation of how the problem solving process proceeded is clear from the explanation
(7) The entries consist of writing which is clear and grammatically correct
(8) A conclusion about the solution to the problem is reached

Note that to receive full credit you must go beyond simply solving the problem as posed. Learn to think of your solutions as a starting point.

Midterm and Final Examination: There will a final exam during the December exam period and a midterm around midway through the term. The time and date of these exams will be announced.

Schedule:

Date	Topic	Remarks
Sept 5	About the class, introductory problem	first assignment (files/ass1.pdf) - due Sept 11
Sept 10	telescoping sums (youtube) (https://www.youtube.com/watch?v=H6MmDRtuiNw), notes (files/telescoping.pdf)	
Sept 11	tutorial - discuss first (files/ass1.pdf) and second (files/ass2.pdf) assignments	second (files/ass2.pdf) assignment - due Sept 25
Sept 12	numbers, inequalities, AND, OR, IF __ THEN __	
Sept 17	inequalities, ___ IFF ___	
Sept 16	tutorial - discuss second (files/ass2.pdf) assignment	
Sept 19		
Sept 24		
Sept 25		
Sept 26		
Oct 1		
Oct 2		
Oct 3		
Oct 8		
Oct 9		
Oct 10		
Oct 15,16 & 17	Reading Week	
Oct 22		
Oct 23		

Oct 24		
Oct 29	Midterm!	
Oct 30		
Oct 31		
Nov 5		
Nov 6		
Nov 7		
Nov 12		
Nov 13		
Nov 14		
Nov 19		
Nov 20		
Nov 21		
Nov 26		
Nov 27		
Nov 28		
Dec 3		

Announcements:

(September 4, 2019) Welcome. Tutorials for this class will meet for the first time on Wednesday September 11. For the second class I would like you to watch this youtube video (https://www.youtube.com/watch?v=H6MmDRtuiNw) on telescoping sums.

(September 10, 2019) I have had a number of students ask to add this course because it is currently full. Next week (Tuesday September 17) I will give to math majors in their first year permission to enroll. If you are in second year you should be taking Math 2200 (offered Winter term).