Math 1200: Problems, Conjectures and Proofs - Fall 2017/Winter 2018 - Section AY - Zabrocki

Contact information:

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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 inductions, 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.

Other useful references are
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

Participation	based on attendance and in class assignments	
Assignments	roughly one every 3-4 weeks	25%
Quizzes	6 total, 3 per term, best 2 from each term	30%
Final Examination	Winter exam period	45%

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 and you will lose 2 points from your course grade for each class or tutorial that you miss each term. Sometimes attendance at the weekly classes will be measured by a short in class assignment. Non participation in these assignments will result in a lowering of your participation grade. Note that participation is not a percentage of your grade, but non-participation and attendance can lower your overall score.

Assignments: There will be roughly one assignment 3-4 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.

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.

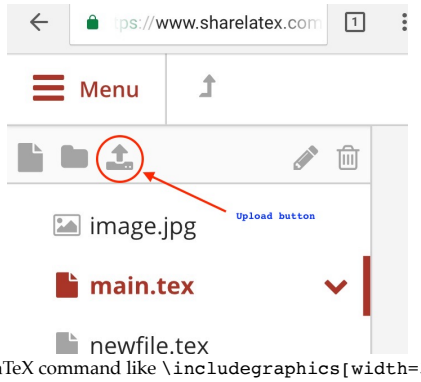
Quizzes and Final Examination: There will be 3 quizzes per term (dates listed below). A final examination will be scheduled for the April exam period and the date announced in late-February/early March.

Announcements:

(September 5, 2017) Welcome! The first day of classes is Tuesday, September 12 and the class will be held in the Life Sciences Building room 107. Instructions about the tutorials (which are scheduled for Wednesdays) will be given on the first day of class. They will meet for the first time on Wednesday, September 20.

(Sept 12, 2017) For next time I would like you to:
(1) read carefully and be aware of the online academic integrity tutorial (https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/)
(2) learn to use LaTeX (latex.html) and write a summary of the problem (files/hw1.pdf) we discussed today in class. I will ask you to hand it in on Moodle.
(3) watch the following video on telescoping sums (https://www.youtube.com/watch?v=H6MmDRtuiNw).

(Sept 12, 2017) While I was in class I was hoping to upload a picture and show you how to insert it in your document, but I couldn't find how to upload a picture onto ShareLaTeX. It turns out that I was missing it because it is subtle and it looks like this:



You might want then to include that image in your file with the LaTeX command like `\includegraphics[width=3in]{image.jpg}`.

(Sept 15, 2017) I adjusted the schedule a bit and corrected the dates for the tutorials. They will meet every other week and both tutorials will meet the same day. There will be 12 meetings of the tutorials and during 6 of those we will have the quizzes.

(Oct 2, 2017) You will have a quiz tomorrow in the tutorial. You will need to be able to prove a sum formula using telescoping sums (https://www.youtube.com/watch?v=H6MmDRtuiNw). You will also need to justify a some simple logical statements or provide a counter-example.

(Oct 2, 2017) I read your homework assignments and gave you some feedback. Everyone who handed in a latex assignment got full credit, but future assignments will be evaluated more on content. Some general comments about what I saw:

- Reread your sentences and make sure they are as simple and clear to another reader as you can make them
- Don't ramble on. Your final solution should be short and direct. We don't need to know your whole process about how you discovered the answer, just a clear and short explanation of why it is true
- Make sure that you define all notation and abbreviations that you use
- Do not begin a sentence with a symbol

List of files:

- homework #1 (files/hw1.pdf)

YouTube videos:

- telescoping sums (https://www.youtube.com/watch?v=H6MmDRtuiNw)
- if...then... statements (https://www.youtube.com/watch?v=qxDs70Ct6gw)
- getting started on Sharelatex (https://www.youtube.com/watch?v=A5nssAJBBPY)

Schedule (Tuesdays during the Fall and Winter term):

Date	Topic	Remarks
Sept 12	About the class, introductory problem	Hw #1 (files/hw1.pdf)
Sept 19	On writing math and solving problems (files/in_class_assignment.pdf) (latex (files/in_class_assignment.txt))	academic tutorial (https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/), HW assignment (files/hw1.pdf), watch Telescoping sums (https://www.youtube.com/watch?v=H6MmDRtuiNw)
Sept 26	Discussion about logic	
Oct 3	More logic discussion	Watch a video on if...then... statements (https://www.youtube.com/watch?v=qxDs70Ct6gw)
Oct 10		
Oct 17		
Oct 24		
Oct 31		
Nov 7		
Nov 14		
Nov 21		
Nov 28		
Jan 9		
Jan 16		
Jan 23		
Jan 30		
Feb 6		
Feb 13		
Feb 27		
Mar 6		
Mar 13		

Mar 20		
Mar 27		
Apr 3		

Schedule (Tutorials every other Wednesday during the Fall and Winter term):

Tutorial 01 is in DB 0013 on Wednesdays at 10:30-11:30am
Tutorial 02 is in CB 122 on Wednesdays at 10:30-11:30am

Date	Topic	Remarks
Sept 20	First tutorial	second hw assignment (files/hw2.pdf)
Oct 4	Quiz #1	
Oct 18		
Nov 1	Quiz #2	
Nov 15		
Nov 29	Quiz #3	
Jan 10		
Jan 24	Quiz #4	
Feb 7		
Feb 21	Quiz #5	
Mar 7		
Mar 21	Quiz #6	