MATH 101 - SETS, GROUPS AND TOPOLOGY, FALL 2018

MF 9AM-10h15, SC 310

Instructor: Sebastien Vasey **Office:** Science Center 321H
Email: sebv@math.harvard.edu **Office hours:** TBD

Course assistants: Michele Tienni (micheletienni@college.harvard.edu) and Grace Whitney (g_whitney@college.harvard.edu)

Course website: http://math.harvard.edu/~sebv/101-fall-2018/

Course overview. The course aims to introduce you to proof-based mathematics. In mathematics, when we say a statement is true, we usually mean something very precise: there is an unambiguous argument, a *proof*, which explains *why* the statement is true. The course will study those mysterious proofs. We will discuss:

- What they are.
- How to understand and appreciate them.
- How to verify them, and most importantly:
- How to *write* your own.

We will see that (at least in mathematics) there is a big difference between saying "I believe X is true" and "X is true". All throughout the semester, intellectual honesty and critical thinking will be encouraged.

Another goal of the course is to introduce several mathematical topics (logic and set theory, group theory, and low-dimensional topology) that are fundamental to further mathematical practice and also crucial in computer science and engineering. These topics will be developed from first principle and will serve both as motivation and examples in our study of proofs.

Course texts. We will primarily be using the following textbooks (*all are freely available online* - see the course website for links):

- For foundational material: Richard Hammack, *Book of Proof*. 2nd ed., 2013.
- For group theory: Tom Judson, *Abstract Algebra: Theory and Applications*, 2017 ed., Orthogonal Publishing, 2017.

- For analysis and topology: Stephen Abbott, *Understanding Analysis*, 2nd ed., Springer-Verlag, 2015.

Some other *optional* references can be found on the course website.

Prerequisites. There are no formal prerequisites. Our approach to mathematics will probably be very different from the one you learned in high school or in calculus courses, but it will be helpful if you remember some basic algebra, geometry, or calculus.

Assessment. Your grade for the course will be determined by scores on homework assignments, three exams, and a final project as follows:

- There will be three exams: a pre-midterm, a midterm, and a final. They will collectively count for *60%* of your final grade. Your lowest score will count for *10%* and the other two will each count for *25%*.
- There will be a *final project*, which will count for *10%* of your final grade.
- There will tentatively be 20 *homework assignments*. Cumulatively, they will count for *30%* of your final grade. Your lowest two homework scores will be dropped. See below for more details on homework assignments.

The *highest* grade cutoffs will be as follows: 90%: A, 80%: B, 70%: C, 60%: D. These cutoffs *might* be lowered, but will not be raised. This means, for example, that you will be guaranteed an A if you score 90% or more, regardless how the rest of the class performs.

If you qualify for special accommodation (such as extra time) for the tests, or if you already know you will not be able to take one of the tests at the planned time (e.g. because of a religious observation or a university event), please let me know as soon as possible.

Exams. There will be three exams that will take place during the semester. The (tentative) dates are below:

- The *pre-midterm* will take place on Friday, October 5 from 6 to 8pm.
- The *midterm* will take place on Friday, November 2 from 6 to 8pm.
- The *final* will take place on Monday, December 3, from 5 to 7pm.

Location of these exams will be announced soon.

Project. For your *final project*, you will explore a mathematical topic of your choice. You will have to produce a written introduction to this

topic. This project will be done in groups, during the last third of the semester. Further details will be provided then.

Homework assignments. They will be announced in class and posted on the course website. Solutions will typically be posted the day after an assignment is due. Assignments will usually be due at the *beginning* of class. Only partial credit will be given if an assignment is turned in late, and no credit if it is turned in after solutions have been distributed. Assignments have to be submitted *online*, via the course's Canvas site (scans are acceptable).

Assignments are one of the key elements of this course and they will be checked very thoroughly. You should make every effort to write down your thoughts clearly and precisely. Your writeup should contain little to no extraneous material (no scrap work). I also encourage you to *be intellectually honest*: it is better to say that you are not exactly sure how to solve a problem / justify a particular step and write your thoughts than to write three pages of obscure equations and hope the grader will trust your solution to be correct.

On the first page of your assignment please include:

- Your full name.
- The *list of other students with whom you collaborated* (if any).

As long as you list your collaborators, collaboration is allowed and encouraged. You may discuss ideas on, and even possible solutions of, specific problems. *However*, you may *not* maintain a record (written, audio, photographic, etc.) of the discussion. This means that *you are required to write up solutions entirely on your own* and that you cannot show the assignment you are submitting to other students. For example, if you discuss a problem with others using a blackboard, you must erase the board once the discussion is over and write up the solution on your own.

Reading assignments. The reading assignments that are relevant for the lectures of any given week will be posted to the course website at the end of the previous week. You will benefit from looking at the reading before coming to class.

Resources for help. Many resources outside of class are offered, and I highly encourage you to take advantage of them:

- *Office hours (in my office, SC 321H)*: Office hours are times when I will be sitting in my office, just waiting for you to come ask me anything related to this class. You don't need to make an appointment to visit me during office hours; just come by! If

you can't make it to my scheduled office hours, you are always welcome to email me, and we can set up another time to meet.

I'll announce the times of my office hours soon, after I've had a chance to look over your schedules.

CAs will also hold office hours (to be annouced).

- *CA problem sessions*: Course assistant(s) will hold weekly problem sessions, and you may attend any CA's problem session. Times will be posted on the course website soon.
- *Math Night*: Math Night will be held every Monday night (starting Sep. 10), 8-10PM at the Leverett house dining hall. It is hoped that you will find students from Math 101 (or other math classes) there to work on problem sets or get help with them. "Extra special" food is promised. The website for Math Night is:
`http://math.harvard.edu/undergrad/mathnight.html`.

Other policies.

Contacting me. Feel free to talk to me anytime. I will often be in my office, and you are welcome to drop by, but I might tell you I am busy if you come outside regular office hours. The best way to otherwise contact me is via email, as it provides me with a written record of our conversation.

Attendance. I strongly encourage you not only to attend lectures, but also to actively participate in them: stop me if anything is unclear and feel free to share your thoughts about the material (what do you find easy? What do you find hard?).

I expect your full attention during lectures: no loud conversation, use of cell phones, or other activities unrelated to class.

Grading issues. If you have any questions or complaints concerning the way an assignment has been graded that cannot be resolved with the CA, please come talk to me. You should first look at the official solution and make sure you understand it.

Academic integrity. Any acts of academic dishonesty, such as cheating, plagiarism, etc. will be dealt with according to University Policy. Examples of violation include searching the web (or inside a textbook) for solutions, copying part of another student's assignment or showing your assignment to another student. Please speak to me if you have any questions about this.