

*Math 460/500: Geometry-Topology I*  
*Fall 2013*

**Instructor:** Dr. Patricia Cahn

**Office Location:** DRL 4C7

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**Office Hours:** Wednesday 12-1, Friday 3-4, Monday 12-1 (Math 460/500 only), and by appointment.

**Course Meeting Times:** Tuesday, Thursday 3:00-4:20 pm

**Grader:** Matthew Tai.

**Office:** 3C15

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**Course Description:** This course covers point-set and algebraic topology. In point-set topology, we generalize the ideas of open sets, continuity, connectedness and compactness from analysis. Topology can be viewed as qualitative geometry; rather than paying attention to distances, curvature, and other quantitative properties of a space, we study the connectedness of the space, whether it has "holes," and so on. In algebraic topology, we build tools for converting problems in topology, where there is little structure, into problems in algebra, where there is a lot of structure.

Topics covered: Point set topology: metric spaces and topological spaces, compactness, connectedness, continuity, extension theorems, separation axioms, quotient spaces, topologies on function spaces, Tychonoff theorem. Algebraic topology: Fundamental groups and covering spaces, and related topics.

**Prerequisites:** Officially, Math 240/241, Math 360 or 508, or permission of the instructor. Unofficially, you need to have experience writing proofs. You also need some group theory (370 or 502), but this may be taken concurrently, since we won't be using it until the second half of the course.

**Teaching Methods:** This is a master's level course and will be taught in a lecture format. For some of you, this is your first graduate course. The purpose of the lecture is to demonstrate proof techniques and provide perspective that you may not obtain from reading the book alone. In order to really learn the material, you will need to read the textbook on your own, either before or after the lecture, and work through the details of the proofs. It's helpful to try to prove something yourself, or at least guess the strategy, before reading the proof. If your idea is different from what the book does, try to figure out why. Does your idea not work (why?), or did you find a different proof? Also, make a point of looking for the points in the proof where the hypotheses are used. After you've read the text, try the homework problems. Often the proof techniques in the chapter reappear in the problems, so it's much more efficient to read the chapter first! Moreover, you'll improve your ability to read mathematics, which will help you in all of your math classes. If you have trouble with the homework or the reading, please come to office hours. I'd even say that coming to office hours with good questions is just as important for learning the material as going to lecture!

**Academic Honor:**

On homework: You are strongly encouraged to collaborate with your classmates on homework. What is important is a student's eventual understanding of homework problems, and not how that is achieved. However, *your write-up must be your own, and represent your own individual understanding of how to do the problem. Please list the names of the students you worked with on the top of your homework assignment. You may use any references you like (electronic, living, printed) on your homework, provided you cite them properly.*

On exams: No outside sources (electronic, living, printed) of any kind may be consulted, with the following exceptions: On the take-home exam, you may consult your *own* course notes, exam, and homework, any material on our Blackboard site, and the official course textbook, Munkres' *Topology*.

Penn's Code of Academic Integrity applies to this course.

### **Student Needs:**

Students with disabilities are encouraged to contact Student Disability Services, which is part of the Weingarten Learning Resource Center, so that appropriate accommodations can be made.

I understand that students may have religious observances that occur during the semester and conflict with classes or exams. Please let me know about all such conflicts by the end of the second week of class, so that we can make arrangements.

### **Additional Support for your Learning:**

Weingarten Learning Resource Center: [The Office of Learning Resources \(OLR\)](#)

The Office of Learning Resources at the Weingarten Learning Resources Center offers individualized instruction and a variety of workshops to guide Penn students towards more efficient and effective academic study skills and strategies. Professional staff provides free and confidential instruction in areas such as time/project management, academic reading and writing, exam preparation and test-taking strategies, and study strategies. The office is located in Stouffer Commons, 3702 Spruce Street.

Stop by to use the study lounge or computer lab or to pick up self-help brochures and semester calendars. To schedule an appointment with a Learning Instructor, call (215) 573-9235 or visit in person. To learn more about Weingarten's services, visit [www.vpul.upenn.edu/lrc](http://www.vpul.upenn.edu/lrc).

### **Grading:**

#### *Graded Activities:*

Your grade will be based on homework, one in-class midterm, one take-home midterm, and a final exam. In addition, you may choose to write an optional final paper on a topic related to the course.

**Homework:** There will be two types of homework problems: exercises and problems. You need to do both in order to learn the material, *but you only need to turn in the problems*. I am happy to discuss both exercises and problems in office hours.

**Optional paper:** You may choose to write a 5-10 page paper on a topic related to the course. If you do not write a paper, I will compute your grade using Option 1 below. If you do write a paper, I will compute your grade using Option 2.

Should you write a paper? Writing a paper gives you an opportunity to explore a topic of interest to you in a structured way, and should be a fun endeavor. I understand that for some of you, it is more important to focus your time on studying for the final, especially if you plan to take the preliminary exam soon. I'm happy to meet with you if you need help deciding whether to write a paper, and what to write about.

*Computation:*

Option 1: No paper.

Homework: 25%

Midterm 1: 20%

Midterm 2: 20%

Final: 35%

Participation: Includes classroom attendance and going to office hours. Used to determine borderline grades.

Option 2: Paper. In-class tests are given less emphasis; homework and take-home remain unchanged.

Homework: 25%

Midterm 1: 15%

Midterm 2: 20%

Final: 30%

Paper: 10%

Participation: Includes classroom attendance and going to office hours. Used to determine borderline grades.

*Evaluation:*

So, your homework and exam grades are based not only on the completeness and correctness of your solutions, but on the clarity of your solutions and the quality of your writing.

*A well-written proof, at this level, should contain enough detail that no effort is required on the part of the grader to understand your solution.*

You should envision the audience for your proofs as a smart peer—someone with your level of mathematical background, who can also detect holes and notice errors in arguments.

*A well-written proof should not only be understandable to the grader, who already knows how to do the problem, but should be clear enough that it can be used to teach one of your peers, who has not seen the problem before, how to do the problem.*

*Policies:*

Late homework will not be accepted, except in rare circumstances such as serious illness or a family emergency. By beginning your homework early, you are guaranteed to have something to submit. Homework should be submitted at the beginning of class on Tuesday. We will drop the lowest homework score.

Questions about homework grades should be addressed in writing to the grader.

Questions about exam grades must be directed to me *in writing* within one week of the date the exam was returned. You should write a short explanation of your concern and attach your exam.