

MATH 342: TOPOLOGY
COURSE INFORMATION & SYLLABUS

SPRING 2021

Place:	Vollum Lecture Hall / the Internet
Time:	MWF, 13:35–14:25 asynchronously via lecture recordings
Instructor:	Kyle Ormsby (ormsbyk@reed.edu)
Student Hours:	MWTh 15:00–16:00
Textbook:	<i>Topology: A Categorical Approach</i> by Bradley, Bryson, & Terilla
Supplies:	graphics tablet or tablet computer with stylus (recommended for online collaboration)
Website:	people.reed.edu/~ormsbyk/342/

Course description. This course is a rigorous exploration of topology — the study of mathematical phenomena that are invariant under continuous deformations — couched in the language of category theory — a general framework for unifying mathematical structure across disciplines.

Learning outcomes. By the end of this course, I am confident and hopeful that you will be able to:

- » converse in the languages of topology and category theory;
- » utilize universal properties and concrete constructions to define mathematical objects and manipulate them;
- » understand and utilize theorems and concepts from topology such as connectedness, compactness, Hausdorffness, Tychonoff’s theorem, one-point and Stone-Čech compactifications, the fundamental group, and the Seifert van Kampen theorem;
- » understand and utilize theorems and concepts from category theory such as functors, natural transformations, the Yoneda lemma, (co)limits, and adjunctions;
- » **understand and produce proofs related to the above topics;**
- » apply the above topics in relevant examples and applications; and
- » **communicate mathematical ideas verbally and in writing.**

Distribution requirements. This course can be used towards your Group III, “Natural, Mathematical, and Psychological Science,” requirement. It accomplishes the following goals for the group:

- » Use and evaluate quantitative data or modeling, or use logical/mathematical reasoning to evaluate, test, or prove statements.
- » Given a problem or question, formulate a hypothesis or conjecture, and design an experiment, collect data or use mathematical reasoning to test or validate it.

This course **does not** satisfy the “primary data collection and analysis” requirement.

In-person and remote participation. I will deliver interactive lectures in Vollum Lecture Hall. These lectures will be recorded and posted online for remote participants to view asynchronously. If you attend in-person, you are expected to engage with peers and me in the interactive components of the lecture. If you are participating remotely (either for the whole semester or on an *ad*

hoc basis¹), then you are expected to engage with a small prompt on our Slack workspace (see below). Math 342 does not have a formal attendance policy, but I will use your in-person and Slack engagement to assess the participation portion of your grade.

All students are encouraged to engage in office student hours (see below). I will also facilitate the organization of online study groups, and especially recommend that remote remote participants engage in both of these opportunities.

Texts. This course will follow the required textbook *Topology: A Categorical Approach*, which is available online for free at <https://topology.mitpress.mit.edu/> and also at the College bookstore. The book *Topology* by Munkres is a recommended supplemental text, as is *Category Theory in Context* by Riehl. (The latter is available online for free at <https://math.jhu.edu/~eriehl/context.pdf>.) Each lecture will be paired with a suggested reading. Lectures and readings are intended to complement each other, and you are strongly encouraged to engage with each reading.

Homework. Homework is due via Gradescope² every Friday by 13:00. Homework due Friday of week N covers topics through Monday of week N , and you are strongly encouraged to start homework early so that you can take advantage of office student hours and study groups. Excellent solutions take many forms, but they all have the following characteristics:

- » they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- » when graphical reasoning is called for, they include large, carefully drawn and labeled diagrams;
- » they are neatly written or typeset;³ and
- » they use complete sentences, even when formulas or symbols are involved.

Given the exigencies of contemporary existence, I will be flexible with deadlines as long as you communicate with me about extensions. If health, family, or emergent national crises might impede the timely completion of your homework, please contact me as early as possible.

Collaboration. You are permitted and encouraged to work with your peers on homework problems. You must cite those with whom you worked, and you must write up solutions independently. **Duplicated solutions will not be accepted and constitute a violation of the Honor Principle.**

Expect an announcement in the first week of class regarding a system by which you can coordinate study sessions with peers.

Feedback. You will receive timely feedback on your homework via Gradescope, either from me or the course grader (a mathematics undergraduate). Each homework problem can earn up to five points for mathematical content, and two points for the quality of writing. If your answer is incorrect, this will be reflected in the score, and there will also be a comment indicating where things went wrong with your solution. You are strongly encouraged to engage with this comment, understand your error, and try to come up with a correct solution. You are very welcome to post

¹In-person participants may shift to remote participation for health or personal reasons, but should let me know when they are opting to engage remotely instead of in-person.

²Gradescope is an online homework submission and evaluation platform. You will receive a link to register for our class's Gradescope page during the first week of classes.

³Interested students are encouraged to prepare solutions in the \LaTeX document preparation system. A guide to \LaTeX resources is available on the course website. Nearly all of the .pdf files on the course website are produced by \LaTeX ; you can find their associated source files by changing the .pdf suffix to .tex in the file's URL.

questions about old homework problems to the Slack channel (see below) and talk about them with me in office hours (see the Help section).

Tests. We will have two midterm exams and a final exam. All exams will be open book, open notes, and take-home. They will have suggested time constraints and firm due dates, but you will be permitted to spend an arbitrary amount of time on the problems between when the exam is distributed and collected. Calculators, computers, phones, collaboration, books other than the textbook, and the Internet are prohibited during exams.

- » Exam 1: distributed Monday 15 February, due Wednesday 17 February.
- » Exam 2: distributed Monday 22 March, due Wednesday 24 March.
- » Final Exam: distributed Monday 10 May, due Wednesday 12 May.

Joint expectations. As members of a communal learning environment, we should all expect consideration, fairness, patience, and curiosity from each other. Our aim is to all learn more through cooperation and genuine listening and sharing, not to compete or show off. I expect diligence and academic and intellectual honesty from each of you. You should expect that I will do my best to focus the course on interesting, pertinent topics, and that I will provide feedback and guidance which will help you excel as a student.

Help. There are a number of resources you can access for help with this course's content. Everyone is welcome and encouraged to attend my office student hours.⁴ These will be held online Monday, Wednesday, and Thursday 15:00-16:00 on a drop-in basis; see our Slack workspace for a Zoom link to attend. I am also happy to arrange student hours by appointment. Student hours are an opportunity to clarify difficult material and also delve deeper into topics that interest you. Please reach out to me if there are barriers preventing you from effectively utilizing this opportunity.

Additionally, every Reed student is entitled to one hour of free individual tutoring per week. Use the tutoring app in IRIS to arrange to work with a student tutor.

Slack. Our class has a shared Slack workspace which you can use to ask questions (of me or the class), collaborate on problems, respond to remote lecture prompts, and share resources. The Slack workspace is an extension of our classroom and the above joint expectations extend to this setting.

You will receive an email invitation to join our Slack workspace during the first week of classes. Please use channels and threads to keep conversations organized.

Technology. The use of electronic devices (cell phones, computers, tablets, calculators, *etc.*) is prohibited in the classroom without prior authorization from the instructor. That said, legitimate uses of technology (*e.g.*, note-taking) will be accommodated — just talk to me first.

The Internet. You are welcome to use Internet resources to supplement content we cover in this course, with the exception of solutions to homework problems. **Copying solutions from the Internet is an Honor Principle violation and will result in an academic misconduct report.**

Academic accommodations. If you have a documented disability requiring academic accommodation, please have Disability & Accessibility Resources (DAR) provide a letter during the first week of classes. I will then contact you to schedule a meeting during which we can discuss your accommodations. If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DAR.

⁴See <https://blogs.agu.org/geoedtrek/2020/07/30/office-hours/> for some of the reasons I'm re-branding office hours in this fashion. I hope you'll attend!

Math in the Time of COVID-19. It is essential that all students, faculty, and staff at Reed follow the College’s public health rules and guidance during the COVID-19 pandemic. This will help ensure your and the community’s safety. During our class periods, in-person participants must wear a mask covering their mouth and nose, and they must remain six feet (two meters) distant from other class members.⁵ Carefully track any cold/flu/COVID-19 symptoms you are experiencing and **do not come to class in-person if you are ill.** I will periodically ask to see your Daily Health Check (green ‘Go’ sign).

Grades. Your grade will reflect a composite assessment of the work you produce for the class, weighted in the following fashion: 35% homework, 25% final exam, 20% exam 2, 15% exam 1, 5% class participation.

Remember: *Math is hard, but we’re going to get through this together!*

Contract. I have read this syllabus and will ask questions regarding any portion of the course structure or policies that that is unclear.

Printed Name	Signature	Date
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Use the space below to ask questions about the syllabus and course:

⁵This can be especially challenging when entering, exiting, or moving about the classroom. It’s OK to be slightly closer than six feet when moving through space, but please move quickly and do not linger in any one person’s vicinity.