

INTRODUCTION

When my son started college, he tried to convince me there was no need to attend lectures. “Lectures were invented to make information available to students,” he said, “and there is a newer technology, called printing, which does this more conveniently and effectively.” I argued that the lecturer might say things in a different way, which could be helpful for understanding, and that in addition, seeing and hearing an argument or example constructed is different from just reading the polished, finished product. I think I convinced him that attending lecture was better than just reading the textbook.

I was wrong! Recent education research has shown that as a method of conveying basic information, lectures aren’t any more effective than reading, and are far from the best use of class time. According to the research, here is the best way to organize a course. Students should get an introduction to basic information and do some initial work, before class. The advantages of classtime — the instructor as an information source and interacting with other students — are best used for checking and extending the work done before class. After class, additional homework solidifies knowledge and skills.

But doesn’t the most effective course organization vary for different students? It may seem like the new plan might not be the best for the students who’ve always done well in traditional lecture courses. Or it might not work well for students at the other extreme, those who are struggling the most with the course. Surprisingly, the research shows that when performance data is split into groups like this, usually all groups do better with the new plan than in traditional lecture courses, no group ever does worse, and most or all groups in most classes do significantly better. (Some of the research is specifically on college math classes, including post-calculus, and lots has been done on college science classes. If you are interested in more details, see links to research on the course website.)

Switching classtime from lecture to active learning is a particularly good idea for a topology course. Topology is sometimes described as the math that can’t tell a coffee cup from a donut. The idea is that topology cares only about properties that are preserved by continuous deformation. By such a deformation, we move most of the mass of the donut to one side. Leaving the “small” part of the donut to be the handle of the coffee cup, we flatten the fat part into a disc and then shape the disc into the cup part which holds the coffee.

To make these intuitive descriptions into mathematical arguments, we need mathematically precise versions of the definitions and techniques used. An even bigger challenge is presented by comparing the [surface of a] donut and a sphere. It seems obvious that to make a sphere into a donut, we’d have to rip a hole in it, and that isn’t “continuous deformation.” But just trying and failing to find a continuous deformation between the two is not a proof. We must show there isn’t *any* possible way to find one. Proving this requires a topological point of view, a new conceptual framework. In this topological viewpoint, familiar ideas like continuity, limits, and what it means for points to be “near” each other can be abstracted until they are almost unrecognizable. The high level of abstraction is a major reason many students find Math 441 very challenging.

A second reason is the emphasis on proof. In this course, “problem” will usually mean “proof.” Past experience with Math 441 has shown that the usual “lecture, then homework” model isn’t effective for helping all students develop a new conceptual framework and proof creation skills.

COURSE ORGANIZATION

For almost every class, you will prepare with reading and Warmup Problems. A written Reading Response will be due 24 hours before the start of class. (Details on content and turn-in for this and other assignments given elsewhere.) You will turn in a copy of your advance work on the Warmup Problems by the start of class.

Classtime will usually start with a discussion of questions raised in the reading responses. Then you will work in groups to check the Warmup Problems, asking the instructor(s) for help. After your group has agreed on a solution, you may be called on to post it on the board for whole class discussion.

Followup Problems will be assigned on the material from each class, and will be due once a week. You may work with others in the class to figure out these problems, but do not look at anyone else's final written solution. The work you had in must be your own thoughts in your own words.

A word of warning. Many previous 441 students who used the internet to help with homework became dependent on "internet-assisted" proof writing. This resulted in artificially high homework scores and miserably poor exam scores.

DO NOT LOOK FOR MODEL PROBLEM SOLUTIONS ON THE INTERNET!

The best idea is to avoid all use of the internet for this course except for the course website and Canvas site.

There will be a midterm, tentatively on Friday, November 2, in class, and a final exam 8:30-10:20 AM on Thursday, December 13. Either or both tests may include a takehome component.

GRADES

Each Reading Response (RR), set of Warmup Problems (WP), and day of Classwork (CW) will be scored on a 0 to 2 scale. The total of the RR, WP, and CW scores will be 25% of your course grade.

The Followup Problems (FP) will be graded in detail, with a point score for each problem. Your total FP score for the quarter will also be 25% of your course grade.

The midterm and final exam scores will be added together; the final will be approximately 2/3 of the test total. Your total test score will be 50% of your course grade.

The scale for converting percentage to decimal grade will be set at the end of the quarter. My preliminary estimate is that the scale will be linear with 95% the minimum for a 4.0, and 75% the minimum for a 2.0. The actual scale will be no tougher than this preliminary estimate; that is, your course grade will be at least as good as the preliminary scale indicates. In addition, I may consider an alternative weighting scheme (e.g., with the final exam counting more to account for improved performance). If so, your course grade will be the higher of the two grades calculated for you.

If at any time during the quarter you believe there are exceptional circumstances (e.g., serious illness) that make the grading scheme inequitable for you, please see me to discuss it. Note: Missing a single class will not be regarded as "exceptional" no matter what the reason.