

MATHEMATICS 302, PART II

Apprentice Teaching II

University of California, Riverside
Winter Quarter, 2003
Reinhard Schultz

Preamble

Before proceeding, it is useful to look back to the previous quarter. Most of the topics in that part of the course deal with basic day-to-day issues like structuring a class meeting and managing tasks outside the classroom. If you are having difficulties with these items, now is a good time to work on overcoming them. In particular, it is not really possible to work on involving students during class if there are no (major) problems with structuring class meetings or dealing with discipline problems.

Reminder. The UCR booklet, *The Next Step: A Handbook for UCR Teaching Assistants*, contains a great deal of information that either complements or supplements these notes. Every TA should have a copy of this handbook; the Teaching Assistant Development Program (TADP) distributes the booklet free of charge. There will be references to it at various points throughout these notes.

I. RESPONSES TO TYPICAL STUDENT COMMENTS

This can be viewed as a supplement to the previous unit on relating to students. Experience shows that many of the students' negative comments about mathematics and their courses do not change much from one quarter to the next. However, it is not always easy to provide good answers to such questions on the spur of the moment, partly because they may not be expected and partly because there is often some merit in the students' views that must be taken into account. Therefore a list of frequently stated comments with typical answers is given here. Much of this was inspired by material put on the web by Professor Peter Alfeld of the University of Utah (see www.math.utah.edu).

Being lost in mathematics is just the way things always are. — A student who feels this has probably never been ready for the subject matter in his or her courses. This problem builds upon itself, and the best way to resolve it is to start as soon as possible with courses at a level that the student can master. Successful experiences in one mathematics class generally lead to the same in subsequent classes.

The lectures and textbooks are not understandable. — Part of this is closely related to the feeling of being lost, but there is more to it. A textbook is not like a popular novel. The difficulty and importance of individual pages vary substantially in a thousand page textbook. Working hard to understand the most difficult and important pages will allow a student to go through the rest of the book with relative ease.

There is too much material in the book for the student to master. — As noted above, some of the material in a long text is more important than the rest. Textbook writers need to cover many little things at great length in order to conform to publishers' requirements (they want their books to be suitable for the largest possible market). Course lectures and discussions should be designed to cut through the clutter and focus on the most important aspects of the course. Once these are understood the student is in a position to help himself/herself in assimilating the rest of the course.

Mathematics is just a collection of facts that have to be memorized. — It is better to view mathematics as a logically connected system of facts and concepts. If one understands these connections then it is possible to get through the subject more successfully, knowing how to proceed on one's own in dealing with whatever difficulties may arise. In the long run it is more efficient to understand the underlying logic than to memorize all the formulas and recipes.

The solutions of problems require collections of tricks pulled out of a hat. — The methods for solving many problems are the result of long processes of refinement with many false starts and wrong turns that have been left behind. It may be instructive for the student to look at the problem from scratch to see how one is led to the procedures we use today.

Mathematics courses are just obstacles that one needs to cross in order to get a degree, and the material itself is not relevant to what the student wants to do. — The ability to use mathematical methods and ideas is becoming increasingly important almost everywhere in life. The student may be advised to speak with someone knowledgeable with the sort of thing he/she anticipates doing in the future and to ask how important mathematics is in that context. It is likely that the answer will indicate that mathematical skills are at least highly desirable and in many cases indispensable.

When solving assigned problems it is often unclear what the instructor wants the students to do. — There are two answers to this. The first is for the student to look through his/her notes and the book to see if he/she can find something similar. This is particularly appropriate for routine exercises. A second answer is that the instructor wants the students to think. Often questions are designed to expand upon a student's understanding a little beyond what it was before. Here are some standard questions to help make the student think: How is this related to what was done before? What is the problem trying to teach? What should the answer look like? Has this sort of problem appeared before? Can it be solved similarly? How does it relate to other problems?

This piece of mathematics in the course could not ever possibly be useful. — The study of mathematics is not just training to use an assortment of methods that can be used to solve problems in other courses. Students will be working for several decades after leaving college, and no one can anticipate exactly what sorts of mathematics will be needed in the future beyond those that are needed now. It is important for students to have some idea of how to approach new mathematical topics and to learn them as needed in the future. The following student comment in the book, *Been There, Should've Done That* (Second Ed., by Suzanne Tyler, Front Porch Press, Haslett MI, 2001, ISBN 0-9656086-1-1) may also be worth mentioning: "Math opens the door to some great majors. Hang in there."

More examples should be worked out in the lectures. — There should be some examples in the lectures, but some time is also needed to explain the underlying concepts. Although techniques are taught, the understanding of at least some techniques is also part of the course; if overdone, examples can lead to a recipe type approach to learning the subject.

It is embarrassing or too time consuming to ask questions in class. — Instructors differ in the extent to which they encourage questions, either consciously or unconsciously, and in the ways they respond to questions. However, most welcome questions and find them to be a useful way of receiving feedback about how the course is going. In some cases questions can be particularly valuable in allowing the instructor to adjust the presentation in class. Also, in many cases other students have similar questions that will be answered at the same time, and even in cases where students had not thought of the question the answer may be beneficial. Students should not worry about embarrassing themselves in the eyes of the instructor because his/her experiences probably include things that were far more awkward or embarrassing; as noted above, embarrassing oneself in front of classmates should not be a major concern because other students probably have similar questions and the instructor should be capable of answering in a professional manner. If an instructor does not have time to answer a question in class, then there is still the option of offering to talk with the student privately after class or during office hours.

It is difficult to prepare for a test. — Limiting one's focus to things that will appear on the next examination can fulfill the short-term goal of getting a better grade, but it does not fulfill the long term goal of understanding the subject well enough so that it can be used in the future. Many examinations are somewhat contrived and they end after some fixed period of time. Classes are given so that students obtain some command of the subject matter, for example whatever might be needed in an appropriate career. If one focuses on the long term aspects of the course it is likely that this will provide an adequate preparation for the examinations.

Here are some suggestions for effective preparation: (1) Reading through the material both before and after the lectures. (2) Looking over the exercises, thinking about how to approach them, what they might be trying to teach, and what one might expect to happen. (3) Working with a study partner, which is often extremely productive. (4) Going to the instructor or TA when help is needed.

Next, here are some suggestions for success on the exams themselves: (1) It helps to be relaxed. (2) Frequently it is useful to look through the entire exam before starting to answer the questions. This provides an opportunity to answer the easier questions first and leave the difficult ones until later. (3) If there is time left after answering all the questions, it is worthwhile to recheck the answers.

With books and computers available we can look up any information we need. We should be learning to USE information, not MEMORIZE it. — It is not possible to use information effectively unless one is acquainted with the basic framework within the material lies, and some memorization is absolutely necessary for this. Certainly it is possible to overdo requirements for memorization and students should try to understand material as a logically organized body of information, for such an understanding is what makes it possible to use the subject matter for a given purpose. However, this is often not easy, and many instructors and students find rote learning of material to be the path of least resistance.

What if

The following are more properly responses to students' actions rather than their specific questions.

What if a student is extremely worried about the final grade? — It is more effective to be concerned about understanding the subject matter, for good grades should then be a natural consequence. The advice about relaxing during the exam is also worth mentioning here.

What if the student does not attend class regularly? — If the class is so easy for the student that attendance is unnecessary, then it might be worthwhile for the student to check with the advisor about options for skipping the class. If a student has so much to do in his/her work or personal life that class attendance falls by the wayside, then the student should take a hard look at his/her priorities. Most mathematics courses require focused effort, and if this cannot be done then time and money are probably being wasted. It might be better for the student to take a break from school and return when other things are more in order.

What about a student who often leaves class early? — The student has a right to leave, but he/she should also consider the effect of getting up and leaving. Often this interferes with the class and is distracting to everyone else. When this happens, it is rude. If a student walks out to protest something, the point will usually not be clear to others. It is better to make the point to the instructor, either in class or (perhaps better) in writing.

What about students who are constantly repeating courses? — Sometimes repetition of courses is unavoidable, but if there is a pattern of this it is necessary for the student to ask hard questions about his/her willingness and ability to commit to the time and effort needed to succeed in the course. If it isn't possible to make this commitment, it does not necessarily reflect badly upon the student, but it does indicate that he/she really is not in a position to study the material successfully.

What about students who cheat? — The ethical considerations are of course important, and they are dealt with elsewhere in these readings. Aside from these, the student who cheats is really wasting his/her time. Frequently cheating simply postpones the day of reckoning when the student will need to know the material. It can leave students unprepared for subsequent classes or make them unable to do the things needed for a job that requires knowledge from the class. In one student's words that were quoted in the October 17, 1999, issue of *Parade* Magazine, "In the end, a lack of knowledge never helped anyone." That same article contained the following less supportive response: "The real question ... why teachers are still giving old-fashioned tests? And is memorization learning?" A response to this was discussed above.