HOW TO STUDY MATH

Topics in a mathematics course are usually developed a logical progression from axiomatic foundations and previously derived results to a theoretical structure of theorems and functions and, finally, to application of this theoretical framework to particular problems. The emphasis in most elementary math courses is on applying theory to problems.

Thus, when you take a math course, you must adjust your study techniques from those used in the usual "reading course to techniques demanded by a "problem solving" course. That is, you must develop a systematic strategy for obtaining the necessary theoretical overview to recognize the appropriate mathematical "tools" required by a given problem, and then practice using these tools in a variety of situations.

A successful strategy must contain at least two parts: 1) a plan for mastering the theoretical overview, and 2) a problem-solving strategy. This paper will attempt to outline a study strategy that you might adapt to a math course. Other strategies are possible, of course. The important thing is to adopt some strategy that focuses on the problem solving nature of an elementary math course.

PREVIEW TEXT

Spend a few minutes before lecture actively looking over the text the instructor intends to cover in class. Familiarize yourself with new terms, review previous theorems and definitions, try to understand the statements of new theorems, and look over any drawings that are given.

This preview of the lesson is not a thorough reading of the material, but it should help you formulate questions that may be answered in lecture and should give you some "signposts" to help you tie the lecture together and progress with the lecturer rather than following along behind.

Previewing should consume perhaps five percent of your total effort in the course.

NOTE-TAKING AND LISTENING DURING THE LECTURE

It is frequently more important to listen to the lecturer and follow his or her chain of thought than it is to copy every detail that is written on the board. If your behavior in class seems mechanical to you, then you are not listening actively. Learn to anticipate the next step the lecturer is to take, or at least formulate questions about where the lecturer is going with the topic.

If note-taking leaves you no time for thinking in class, copy only the key steps and fill the remaining steps in after class. Items that are important include starting points in a progression, assumptions and conditions imposed, applications of theorems, and steps where other steps are combined. Often an instructor will indicate key steps during the lecture.

Other bits of important information to gain from the lecture are the topics, techniques, etc. that your instructor wishes to emphasize and those which he or she wishes to skim or skip.

Review your notes as soon as possible after class while the lecture is fresh in your mind. Fill in missing steps by referring to the text or asking questions of your T.A. or professor. When approaching anyone for help, make sure that you have thought about your problem so that your questions are specific and concise. Well-formulated questions elicit more useful and cheerfully given responses from busy professors and T.A'.s.

READING THE TEXT

During class you will be given a problem-solving assignment. Before attempting to read the text, you should read the assigned problems to formulate questions about how the assignment is to be done. Much of your reading will be geared toward obtaining the information necessary to solve problems. For the most part, you will not read a math text to memorize what is written. Your purpose is to understand the framework in which problems are solved. Consequently, you will do little underlining as you read. Your professor will almost always indicate to you anything you should memorize. This is an essential difference between a "problem solving" course and a "reading" course.

Read your text selectively, letting your lecture notes and homework assignments guide you to those areas your professor wants you to master.

SOLVING PROBLEMS

Solving problems will, in most cases, constitute more than half of your effort in a math course.

For many people, "getting started" on a problem is a major barrier. Frequently, assignments are structured in the following way:

1) beginning problems are straightforward applications of single ideas,
2) intermediate problems combine two or more ideas, and
3) advanced problems require the use of two or more ideas in a new or more abstract setting.

Frequently, problems of type 1 can be solved by modeling your solutions after examples given in the lecture notes or text. However, when modeling your solutions, ask "why" questions and fill in any steps that were left out of examples. Make sure that you are able to "think through" the example that serves as your pattern, as opposed to merely "following through" the example.

The second class of problems (intermediate) are solved by identifying the component ideas and looking for the relationships between them and the overall problem. Your solution should clearly indicate this point of view rather than viewing such problems as distinct and unrelated to the beginning problems. Thus, you will develop a hierarchy consisting of a base of problems involving single ideas and successive levels of problems involving various arrangements of the single ideas.

A working knowledge of the basic ideas and some experience in combining these ideas may allow you to extend them to new or more abstract settings. Such problems require some measure of ingenuity and can be quite entertaining.

Don't be surprised if you encounter a problem that you can't unravel alone. If you have worked the basic material so that you can talk about or recognize the basic ideas, your professor or T .A. may be able to give you some hints. Allow yourself enough time so that you can seek help when you need it. Remember to formulate your ideas about a problem the best you can before consulting with your professor or T .A.

Most professors test their classes almost exclusively over the material assigned as homework. This means that your most important objective in working homework is not to get "answers" to satisfy the homework requirement, but rather to get correct well-thought-out solutions that you will understand as you review for an exam. You should write yourself notes about key theorems you used, key observations you made and transitions between any steps that confused you. Your solutions should read like a story to you so you can understand your solution later without the text.

REGULAR REVIEW AND INTEGRATION OF IDEAS

Now that you have good "readable" solutions to your homework, compare solutions to the various problems. Summarize ideas that are used several times, and take note of the various settings in which they appeared. Contrast differences between problems that require different techniques of solving and categorize problems into a hierarchy from simple to complex.

Such a process of reviewing your solutions to the homework integrates the component ideas into an overview of the topic. Such an overview can become lost in the forest of details if you do not consciously try to keep it in view. The overview is essential to understanding, and aids memory of the necessary details.

You should review your work at least once a week on a regular basis. If you have written some good summarizing notes during these reviews, you will also be able to review your reviews so that you can keep in mind the development of the course from its beginning.

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