



# Mathematics Support Capsules

A Survival Kit for  
First Year Mathe-  
matics Courses

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## 1 Introduction

This handout is intended to be a guide to the ins and outs of introductory courses in mathematics. It includes information on courses, grades, classes, instructors, exams, and studying. It is by no means comprehensive and you will probably have questions that it does not answer. We have tried to answer questions that students ask most often. If you have other questions, *ask your instructors*: they will be glad to help you.

This is not a recipe for learning math without doing any work, nor is it a guide which will guarantee you an "A". Some of these suggestions will prove useful to you; others may not help you at all. If you have suggestions, let somebody in the Math Department know; it will benefit the students who come after you.

## 2 Courses

Before you do anything else, make sure you're in the right course! This can mean one of two things. In the first place you may not be registered for the course you plan to take (or you may be registered for a course you don't want). Whatever changes you decide to make, remember that *instructors cannot sign add or drop slips for you*. You must take them to Arletta Havlik in White Hall 128. Note that this applies also to switching from one section to another within the same course. If you are confused, ask. Try to make changes as early in the term as possible; sections are limited in size, and the one you want may close up if you wait too long.

You also might want to know whether you *belong* in a certain course or not. Talk to your instructor first. If you have questions about prerequisites (e.g., if you are a transfer student or took some calculus elsewhere), AP credit, the different course sequences, or courses in general, you can talk to Professor Steve Chase (White Hall 231, 5-2389, chase@math.cornell.edu), who is Associate Chairman of the Math Department.

If you are interested in adding a course, it is often useful to talk to the person who is teaching it. To find out who that is, consult the lists posted in various places on the first floor of White Hall; alternatively, ask a secretary in White Hall 129. You can also obtain a handout describing the various course sequences. To locate an instructor's office, consult the office directory outside the Math Library (North end, first floor of White Hall).

Note: If you need to get a message or homework to an instructor or TA during the day, leave it with the secretaries in White Hall 129. This office is usually open weekdays from 8:00 AM-4:30 PM. At other times you may deposit such items in a letter drop outside White Hall 125.

## 3 Grades

Grades in elementary mathematics courses are letter grades. The Math Department has suggested grading standards for math courses. For example, the median grade for Math 111 is normally  $C^+/B^-$ . These standards may be useful if you wish to keep track of how you stand during a course. Note, however, that letter grades are usually not given on individual exams.

Grades have a way of making people unhappy, instructors included. Nobody likes to receive low grades and most instructors would be happy not to give them. Some people feel that the whole idea of ranking or evaluating people is wrong and should be scrapped.

The pressures of tradition and society make it unlikely that this will occur. While we should think about the possibility of constructive change, we, instructors and students alike, have to come to grips with things as they are now.

A lot of instructors are in the habit of telling their students not to worry so much about grades—at which point the students are likely to mutter: "That's easy for you to say!" Let's not kid ourselves. Grades are important to a lot of people: the person planning a career in law or medicine, for instance. Everyone would rather receive good grades than bad ones.

However, worrying constantly about grades may not be the best thing *even if all you want is that "A"*. A lot of people find college painful or boring precisely because they have set the wrong objectives for themselves. The ideal reason for going to school is *to learn*, and keeping this in mind is likely to make the experience a great deal more satisfying.

Try to become curious about what you are learning. Ask yourself questions; ask your instructors questions. Why does this work? Why did people think of doing it this way? How can it be used? There's nothing wrong with being directed toward a specific career; if you are, ask how what you're doing relates to it. Even if the specific techniques you learn are not used, the general approach and mental habits you develop may be important.

A lot of people take mathematics simply because they are required to. This is *not* an ideal state of affairs, but it does not mean that you can't benefit from it. If you make an effort to get something out of your course, you *will*, if you don't, it's your time that has been wasted. Concentrate on learning and the grades will take care of themselves.

Most courses are graded on a very rough curve; the curve grades may be adjusted slightly by your TA or instructor for things such as exceptional effort. You should find out at the start of the course how exams are to be weighted, whether low scores are dropped, how much homeworks count, and so forth; these are usually determined by the lecturer.

Instructors often avoid talking about grading policy on the grounds that people will worry too much about grades. Unfortunately, people sometimes worry more when the policy is vague and they have no way of evaluating their progress. You should make your feelings known.

According to University policy the grade of "Incomplete" can be given only when the student has a "substantial equity at a passing level in the course . . ." and "the student has been prevented by circumstances beyond the student's control . . . from completing [the course on time]." If you think you may need an Incomplete, speak with the instructor as far in advance as possible. You should not expect one simply because you don't feel like finishing the course on time.

If, after receiving your grade, you feel that you have not gotten what you deserved, you may wish to speak to the instructor about it. Do so *promptly*, i.e., at the start of the following term. You may look at your final exam, though you are not permitted to take it with you; finals are normally kept in White Hall 129A for a term before being discarded.

While instructors are usually patient with requests for changes, they may become unhappy if they think you are nitpicking. If your grade *really* seems out of line, do speak up; sometimes it is simply not recorded correctly.

## 4 Classes and the Instructor(s)

A few math courses involve two or three lectures and two recitations each week. Lectures can be quite large; recitations, on the other hand, average 20 to 25 students. Other math courses (like Math 111-112) are taught as completely independent sections with never more than 25 or so students per section. Whichever type of course you find yourself in, it is tempting, since instructors rarely take roll, to skip classes now and then. Certainly, in a large auditorium with 100-200 other people, you wouldn't be missed. Why go to class then?

In the first place, for both the lecture/recitation format and the independent sections, your lecturer is almost without exception the person in charge of the course, that is the individual who will have a lot to do with what appears on the tests. If for no other reason, then, you ought to attend class to get an idea of what to expect.

Furthermore, your lecturer will try to explain *why things are true* and *how isolated facts fit together*. Getting the big picture is vital to a thorough understanding of the subject; lectures are meant to help you do it.

If skipping lecture is unwise from the point of view of learning the material, skipping recitation (or skipping a small independent section) is unwise for a more pragmatic reason. Your instructor or TA may appear to be in Outer Space, but don't kid yourself: they know when people skip class. They are people too, and it is hard to think generously of someone who is frequently absent. Remember, these are the people who determine your grade.

Recitations will probably stress problem-solving techniques; the independent sections will incorporate problem-solving within the lectures. In either case, your instructor will spend time working examples and homework problems, and it is a good time for you to ask questions and see the nitty-gritty details that are often omitted from more theoretical treatments of the topic. People often have questions about the material covered in lecture or sections assigned in the textbook; this is the time to straighten out those points that puzzled you. It also helps your instructor associate a person with the name in the rollbook.

There are a number of things you can do to get more out of your classes. For example, people often complain that they are so busy taking notes that they have no time to think about what is being said. If you have this problem, you might find it helpful to organize a group of students in the same class. One person (with legible handwriting!) is assigned to take notes, which are distributed to the group members later; the others are free to concentrate on what the instructor is saying.

It is also good to come to class prepared with questions. You will almost certainly encounter things which puzzle you when you are studying; make a note of them and bring them to class. If you miss a problem on the homework or on an exam, and you fail to understand it after looking at it again, then ask your instructor. If you clear up problems as they arise, things will be easier for you when you're reviewing for exams. You will probably find it easier to ask questions in recitation than in lecture (though most lecturers are pleased when people ask them anything); however, if you are too shy to ask questions during class, you can always ask the instructor afterward. Don't think that your questions are "too stupid" to be worth asking. If you knew all the answers, you wouldn't be taking the course. Your classmates probably have the same questions that you do. Ask! Every sign of interest is welcome.

On those (hopefully!) rare occasions when illness or other emergencies force you to miss class, you should make every opportunity to find out what was covered. You may be able to obtain the notes from another student; you should talk to the instructor about obtaining any handouts that were distributed. Instructors understand that events beyond your control may force you to be absent; you can expect sympathy and tolerance as long as things don't get out of hand.

If, after all this, you decide that you would rather not attend class regularly, be fair to your instructor: do not appear the day before an exam and expect to receive special instruction.

When you are in class, be considerate of the instructor and your fellow students. Instructors get very annoyed when they have to compete with peoples' conversations, and noise makes it hard to understand what a lecturer is saying. Keep your conversations short and as quiet as possible. If you have a question, ask the instructor, not the person sitting next to you.

Homework is usually assigned and collected weekly; your instructor or TA will tell you when it is due. Most often, sample solutions are provided to the assignments; you should go over any problems you missed and be certain that you understand what you did wrong. If you can't figure things out by yourself, ask your instructor. Don't wait until the week of the prelim—ask your questions while they are fresh in your mind.

A lot of people find it helpful to work with others on the homeworks. Aside from being a nice way to make new friends, it is an excellent way to learn. If you get stuck on a problem, chances are that one of your study mates will know how to do it. So collaboration is encouraged, with the understanding that you should write up the problems in your own words for turning in. Copying someone else's solution or the answer in the back of the book may seem like a great shortcut, but there are no solutions to look at when you're taking a test. Sooner or later, you will have to do things yourself.

Since instructors differ in their policies regarding late homeworks, you should find out at the start of the course what is expected of you. Make every attempt to get your assignments in on time; instructors or TAs notice when people constantly turn their homeworks in late.

Keeping up with the assignments prevents you from falling behind the instructors. Don't underestimate the dangers of procrastination! Falling behind in one course can eventually undermine an entire term. Save yourself the misery of cramming and all-nighters and keep up with your work.

Your instructor will post office hours at the beginning of the course. Take advantage of them to ask questions that are too long for class time. Most instructors spend hours sitting in their offices, wondering why no one comes to see them; they are usually impressed when someone does. You will have questions, and bringing them to office hours not only gets them answered, but helps your instructor get to know you.

Occasionally, students have gripes about the way the course is being run. Maybe your lecturer talks too quickly; perhaps your TA is always late to class. When possible, take your complaints about lecture to your TA and your complaints about recitation to your lecturer. Try to be fair; try to suggest ways to correct the problem, and by all means don't wait until the end of the term! Constructive feedback will often produce surprising results. Your instructors are people too—they have days when they feel lousy, just like you do; they often get nervous when speaking to a class, just as you would. Most of them would love to know how they're coming across. Tell them. But don't forget to tell them what they're doing right—that way they'll keep doing it.

## 5 Exams

Most elementary mathematics courses have three prelims and a final; they are scheduled in advance to reduce conflicts, the dates and times appearing in the course catalog. Prelim rooms are normally scheduled at least a week before the test; you should find out where you are supposed to go and make certain you know how to get there. Your instructors will announce the times and places during class.

Few people claim that exams provide a *completely* accurate assessment of what you've learned. Students who work slowly or who "freak out" under pressure are placed at a disadvantage. External factors, from social problems to indigestion, may cause you to do poorly. At best, a test merely reflects the state of your understanding at a given time in a given situation.

Unfortunately, it is hard to come up with a workable alternative. It's true that testing creates pressure and fosters an orientation toward grades, both of which are incompatible with the ideal of going to college to learn. However, testing does insure a certain amount of fairness and objectivity in the evaluation process. As such, you are partially protected from the effects of prejudice or poor personal chemistry. In addition, exams do get you to keep up and learn the material.

What attitude, then, should you take toward exams? To begin with, while not treating them lightly, you should put them in the proper perspective. *Blowing an exam is not the end of the world.* You can still look at them in a *positive, constructive* way. When you get an exam back, begin by congratulating yourself on what you were able to do right. Look at the things you weren't able to do. Review the exam solutions and make a note of the things you missed. At the next possible opportunity, review them: if you are confused, *talk with your instructor.* In other words, use the exam both as proof of the progress you're making and as an indication of the things that require more work. Don't be discouraged if you didn't do as well as you'd have liked. If you've done your best and made a decent attempt to learn the material, *that is all anyone can expect.*

The first thing you need to know to prepare for an exam is the material to be covered. Ask your instructor well in advance. Don't be annoying, but try to get as many specifics as possible. What sections in the textbook will be covered? What material, if any, is specifically excluded? What formulas or information will be provided on the exam? Are there any subjects you ought to concentrate on while studying? Your instructor may wish to hand out "Practice exams," and various fraternities, sororities, and student unions have files of old exams. Ask!

It's usually helpful to begin reviewing well in advance of an exam. Memorizing techniques by brute force is painful and inefficient; if you do a lot of problems over an extended period of time, things will "sink in" with *much less* effort. You should do a broad spectrum of problems, but don't get bogged down in the details of any single one. If you get stuck, it is

better to ask your instructor about it than to beat your head against the wall for an hour.

Try to avoid self-imposed pressure. Pressure can cause you to forget what you've learned; it can lead to careless errors and oversights on exams. This is another reason for beginning your preparation well in advance. Pulling an all-nighter before the exam to cram is not only inefficient from the point of view of learning the material, but also physically and mentally disastrous. Even if what you've studied is still there during the exam, and even if you manage to stay awake, you will probably end up reviewing everything the next time you need to use it.

If you have a time conflict that would prevent you from taking an exam at the scheduled time, you should inform your instructor *well in advance* and find out whether you will have to take a make-up. If so, you should make a note of the time and the place. It is also helpful to remind your instructor of the make-up a day or two before you have to take it—people can be forgetful. **Note:** Since prelim times are listed in the catalog, you will not get a make-up without a very good excuse.

Only a very serious emergency should cause you to skip an exam without informing your instructor. If you do so, you should try to inform your instructor as soon as possible. If you are unable to do it, get a friend to do it for you. You may have to make up the exam later; if so, arrange a place and time promptly. If you skip an exam without offering any excuse, or without contacting your instructor within a reasonable amount of time, do not expect any breaks.

After the exam, check the problems you missed and be sure you understand what went wrong. If you had trouble budgeting your time, make a note to pay attention to this the next time. Check to see that your points were added up correctly—mathematicians can have problems with arithmetic! If you feel that you have not received as many points as you deserve, you may submit it for regrading. **Warning:** If you submit your exam for a regrade, *make no additional marks on it*; doing so is considered *de facto* evidence of cheating. Make any explanations or comments on a separate sheet of paper.

## 6 Studying

This section is not intended to be a comprehensive guide to study techniques; we will focus on problems and methods specific to math courses. Books and pamphlets on the subject may be obtained in libraries and bookstores; your instructor may be able to make suggestions.

We've already suggested that you work with friends on the homework, and collaboration is not a bad idea in general. Be sure, however, that you are really getting something done and not just socializing. Since different people learn in different ways, you should adjust your study techniques to fit your personality. If you feel better studying by yourself, that's fine too. Whatever works for you is probably the best thing.

Use your textbook wisely, not slavishly. No textbook will work well for everyone, and you should not be discouraged if there are parts which you have trouble understanding. When you are reading, make a reasonable effort to understand what the book is saying; if you get stuck, *make a note of the problem and go on*. Take your problems to your instructor. It is frustrating and useless to spend hours crawling through the book line by line, attempting to understand everything the first time through. *Don't create problems for yourself!* Your instructor is there to answer questions; you should concentrate on getting the main ideas and learning to do the problems. A lot of the material in the book is not relevant to the problems that are assigned. Try to do the problems using what you've learned in class; use the book as a reference and a guide. Textbooks usually contain more theory than you really need. Learning the theory behind the detail deepens your understanding; you can see *why* things are done the way they're done and how the subject hangs together. However, your first priority should be acquiring basic functional competence in the subject—i.e., learning to do problems. That is a sizeable task for anyone.

If you have difficulty with the textbook, or if you'd like to see some other points of view, ask your instructor to suggest books for you to look at. The Math Library has a huge collection of calculus books; there are also lots of books in area bookstores. A lot of textbooks have an accompanying "Student Supplement" which you might like to get; typically, it will contain solutions to some of the problems and perhaps a few explanations.

Several years ago the Mathematics Department established a Mathematics Support Center

(255-4658) which is open daily (and Sunday afternoons) in White B-15. It provides a place where students can come to talk about problems that arise in the study of mathematics; these could include specific mathematical questions, fear of tests, uncertainty regarding the appropriate course to take, complaints about a particular course, etc. Although the MSC is not equipped to provide long-term tutorial service, it does engage each semester a small number of undergraduate and graduate-level tutors to provide a limited amount of free spot-tutoring on an individual or small-group basis. The MSC also conducts a number of announced review sessions and workshops on various mathematical topics. Watch for their announcements. Finally, check out the MSC for some written "capsules" on topics of common concern to those enrolled in math courses. Most of them are available free; others (more lengthy) may be purchased for a nominal charge.

If you need extensive help outside of class, you may need to draw upon other resources as well. The LSC (Learning Skills Center—office in Sage Hall, 255-6310) offers support complementary to the services provided by the MSC. In addition, the MSC maintains a list of individuals who are interested in tutoring for an hourly fee; go to White B-15 and ask. Since a private tutor will normally cost \$8–\$12 an hour, you may wish to draw upon the less expensive resources first. Take advantage of your instructor's or TA's office hours; visit the Math Support Center; try the LSC. If these can help, fine. Otherwise, be prepared to dig deep into your bank account!

It is important to budget your time carefully and to keep up with the course. Math courses normally require from 2 to 4 hours of studying per week for each hour of class time. A little arithmetic shows that if you goof off for a week, you will wind up 6 to 12 hours in the hole. It's hard to sit down and study when that prelim is 3 or 4 weeks away. But spending a little over an hour each day is easier than pulling two all-nighters in a row to cram. There is no getting around the fact that math courses call upon you to remember a great deal of information. The efficient way to remember things is to do it in small pieces over a long period of time. Aside from being easier on you, this method makes it more likely that you'll remember things later when you need them. If you learn things *well* as you go through the term, you'll have an easier time when you're studying for the final. You won't need to go back to learn the stuff over again.

Some of the things we discussed when we looked at textbooks apply to doing problem sets. In particular, don't let yourself get bogged down! Some people feel that they have to struggle with a problem until it succumbs, even if it takes the whole evening. While you shouldn't give up *too* easily, you should realize that doing a dozen problems that you *can* do is more useful than wrestling with one that you *can't*. It is important that you see a wide variety of problems, both to broaden your experience and to reinforce your understanding. When it's clear that you aren't getting anywhere, make a note of the problem and ask your instructor about it. If you must do it yourself, put it away for the day and return to it some other time. A day's rest will often produce results.

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There are three ideas which summarize a lot of what we have said here:

- 1) Learning does require discipline and hard work, but...
- 2) ...there are lots of people who are eager to help you, and...
- 3) ...you can make decisions which will have a large effect on whether you learn or not.

If you keep these in mind, you should be in good shape. *Good luck!*