

The Teaching Assistant Manual

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Judith Arms, September 10, 2000

An additional note on authorship

Judith Arms (a professor) and Jed Mihalisin (a TA) wrote much of this manual. First person statements refer to one of these two; you can probably guess which one by content and context.

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Part I

Overview of Being a Mathematics Teaching Assistant at UW

Chapter 1

Duties of TAs

[Hilbert] believed that nothing much was absorbed until it was heard several times. “Five times, Hermann, *five times!*” was the memorable advice he gave to Weyl when that young man started his lecturing career. “Keep computations to the lowest level of the multiplication table” and “Begin with the simplest examples” – these were other favorite rules. – from *Hilbert*, by Constance Reid, Springer 1970, p. 104.

This chapter gives an overview for TAs (and lecturers) of their responsibilities to their students and each other. Although many TA assignments differ in detail from the “typical” assignment that is the main focus here, this description indicates an appropriate workload for a typical TA. Most topics touched on here are discussed in more detail in other chapters.

The usual assignment for most new, and many experienced, TAs is to teach two quiz sections for a calculus or precalculus course, or to teach one quiz section and work in the Math Study Center [MSC] for several hours a week. These courses have lectures on Monday, Wednesday and Friday; each quiz section meets on Tuesdays and Thursdays. TA duties include preparing for and leading class, holding office hours, helping with quizzes and tests (at least grading, possibly writing), facilitating group work, and communicating with the lecturer in charge of the course.

For math 124 and 125, the first two quarters of the “basic” calculus sequence, each quiz section meets for an hour and a half one day a week and for an hour on the other day. These quiz sections will have about 30 students each, and a typical lecture has four such sections. Thus a TA with two quiz sections in these courses teaches five hours of class each week and a total of about sixty students (with half of those students in class at any one time).

Our other beginning courses typically have lectures of 160-200 students divided into four or five quiz sections of 40 students, each which meet for an hour twice a week. Thus TAs in these courses teach four hours of class per week with a total of about eighty students (with half of those students in class at any one time).

Other TA assignments in the math department include grading for advanced undergrad or graduate courses, “tutoring” in the Math Study Center, a small number of computer-related jobs, and teaching (i.e. serving as the lecturer for) an independent section. The latter type of assignment is available to experienced TAs, and includes a variety of courses and schedules. This chapter concentrates on quiz-section assignments.

A regular TA appointment is considered to be a half-time job. Your duties are considered to be a 50% appointment, with an estimated average workload of twenty hours per week.

The Mathematics Department expects you to take this job seriously: Undergraduate education is a major component of the department's mission. At the same time, the job should not overshadow your graduate study. The dual demands of teaching and studying for your own courses sometimes can be overwhelming. Do not hesitate to ask for help and advice. With regard to teaching, assistance is provided by a number of people: Mentor TAs, the Lead TA, the TA Coordinator, and your Lecturer. If you find that your teaching duties are outweighing your studies, contact these people as soon as possible to help you balance your demands appropriately.

1.1 Goals of Quiz Section

Merely hearing something, even Hilbert's "five times," seldom produces understanding or facility. Students need to engage the material actively to find out where they are having difficulties; then they need to be able to get help on those particular points. The main goals of quiz section can be summarized as follows:

- get the students actively involved with mathematics, and
- provide the students with the opportunity to get their questions answered.

Although some lecturers answer questions or have students work on problems in lecture, many don't and in any case more needs to be done. As the name suggests, quizzes usually are given in quiz section, and solutions for quizzes and tests usually are discussed there. If homework is collected, usually it also will be collected and returned in quiz section.

Some lecturers give very specific instructions about quiz section, for instance providing worksheets or telling the TAs which problems or topics to discuss. Or they may specify what you should *not* do, for instance forbidding discussion of homework problems in class. (The philosophy in the latter case is that the homework problems should be reserved for the student work outside of class, with classtime used for presenting additional practice on different problems.) Others leave it to the TA to decide what to cover.

The most traditional style for quiz section is the "question-answer" format: the students ask questions about the homework which the TA answers (or leads the class in discovering the answers). If you use this format, beware of skimping on preparing for class! You still need to work all the problems so you are sure how to do them, decide which topics and problem types are most important to include (and which you will omit, to have time for the most important ones), and prepare some additional questions or problems for the students to work on if they run out of questions. Other class formats include assigning problems or worksheets for students to work on individually, in pairs or small groups, or asking students to present homework or quiz solutions on the board.

Note that lecturing on new material is *not* a good use of quiz section. That job should be done in the main lecture. It may be reasonable to review key formulas, problem solving steps, etc. in the context of working problems, but you should not be lecturing. To achieve the goals of quiz section, key points to remember are the following:

- Maintain good communication with the lecturer.
- Don't duplicate the lecture's function.

1.2 The Format of Quiz Section

If a course has quiz sections it means that the students in the course need an extra opportunity to work with the material and to practice what they have heard in lectures *under the guidance and with the help and encouragement of an instructor (the TA)*. In lectures, students mostly listen; in quiz sections students should do something active. *It is essential then that TAs not waste valuable quiz section time by “sublecturing” in quiz sections.*

Choose topics and modes. Decide *what* you want students to work on (the topic), and *how* they will work (the mode). Examples of topics and modes are given below. During one quiz section you may want to have students work on more than one topic and in more than one mode.

Whatever you have decided to do in quiz section, it is a good idea to announce the agenda at the beginning (“today we work on . . . in the following way . . .”). This is likely to make your work easier—students know what is on the agenda, and such an announcement also conveys to them that you mean business.

Examples of topics:

- questions raised by students
- homework problems chosen by the students or by you
- additional problems chosen by the students or by you
- a worksheet created to develop particular concepts
- a summary given at the end of a section of the course or of the quarter

Examples of modes:

- the TA at the board talking with the entire class
- students working in groups
- students working in pairs
- students working solo then checking answers with neighbors
- students at the board addressing the entire class

Some of these modes combine naturally. For instance, after students work in groups on a problem, you might ask for volunteers to write solutions on the board, or you might lead a class discussion.

The category of topics should naturally vary over the course of the quarter. If you feel that section is dragging or ineffective, make sure that you have not gotten “caught in a rut” by always employing the same type of topic. You should also vary which mode you use unless you have found that a certain mode clearly works best for a particular section. Remember that the goal of quiz section is active learning by the students. **While the most traditional mode is for the TA to be at the board talking with the whole class, this mode has the greatest danger of turning quiz section into a passive experience for the students.**

(This section was adapted from the handout “What to Do in Quiz Section”, by Caspar Curjel.)

1.3 Responsibilities of a Quiz Section TA

The basic duties expected of all TAs assigned to teach quiz sections are the following. Other parts of this TA Manual contain more detailed discussion of many of these points.

1. Prepare for and teach quiz section; follow the lecturer's policy on what is covered in section.
2. Hold at least two scheduled office hours per week (at least one if you have a split assignment), and make appointments as necessary to meet students who have schedule conflicts with your hours.
3. Follow the lecturer's policy on homework.
4. Keep records of the students' scores, including backup copies.^a
5. Administer, grade and return quizzes.^b
6. Help grade tests, following any guidelines established by the lecturer. Help proctor and grade the final exam.^c
7. Communicate with the lecturer and other TAs for the course. (This point is discussed further below.)
8. Attend weekly Monday afternoon meetings about facilitating the Math 124/125 worksheets.^d
9. Get evaluations and advice for improving your teaching.
10. Return the course textbook to C-36 at the end of the quarter!

Notes:

a. Make sure to record all scores before returning any papers to the students. Keep good records and back them up often. Even if there is a separate grader who is tracking the homework, many TAs like to make their own record of scores before returning the papers. This practice keeps them informed on how the students are doing, and provides a backup copy of the scores in case the grader's copy is not available. Finally, make sure that you keep all records, even if the student is no longer in your section. Occasionally, students transfer from one section to another and expect their homework or quiz grades to transfer with them. Sometimes they say something to their new TA or lecturer who promises to get the grades from the previous TA but who then forgets. Sometimes the mistake is not even discovered until after grades are assigned, when a student sees his/her grade and believes it is incorrect.

b. In the past, most lecturers assigned weekly quizzes (where the quizzes were graded by the TA). However, with the introduction of the worksheets in 124 and 125, some instructors have eliminated a majority (if not all) of the quizzes. In this case, an instructor may have a TA put grading time into grading of the worksheets or some other task. Overall, the amount of time a TA spends grading should be the same under either scenario.

c. Check the final exam schedule – see the Time Schedule or ask your instructor – before you make travel plans for the end of the quarter. Allow time for grading exams as well as

taking your own exams before leaving town. The final exam for most sections of 111, 112, 120, 124, 125, and 126 is given on the first *Saturday* afternoon after classes end, and it is graded that weekend.

d. Math 124 and 125 have one quiz section per week that is devoted to worksheets. The quiz section is 80 minutes long so that students have sufficient time to perform the activities. Research indicates that facilitating groups require a different set of instructional skills than presenting concepts at the board. The weekly meetings will cover facilitation skills in general and recommendations for the worksheet administered that week in particular. The goal is to get you prepared to facilitate the worksheets in less time than would be possible if you prepared in isolation. The weekly meetings take place on Monday from 4:00 to 5:00 p.m. You should keep this time slot open. Your instructor may also schedule a short weekly meeting at a different time to keep communication open about quiz sections.

In addition, the lecturer may require one or more of the following.

1. Give the lecturer a brief report after each quiz section (oral, e-mail, or hard copy: lecturer's choice); and/or attend weekly meetings.
2. Create quizzes and/or worksheets for quiz section.^{e,f}
3. Contribute problems for inclusion on tests, and/or proofread quizzes and tests to check for errors, confusing wording, appropriate length and difficulty, etc.^f
4. Meet together for test-grading sessions (as opposed to each person grading at a different time and place).
5. Give each student a grade for their work in quiz section.

Notes (continued):

e. In courses with “long” (hour and a half) quiz sections, faculty should provide all worksheets, quizzes and tests. (This does not preclude the lecturer from asking TAs to proofread or work and comment on problems, wording, etc., in a worksheet, quiz or test.) In courses with only short quiz sections, TAs may be asked to write some worksheets or quizzes. Often TAs for one lecturer will take turns writing quizzes, worksheets, quiz or homework solutions, etc. In any event, the lecturer may want to check a draft before it is finalized, and certainly should be given a copy of the final version.

f. The collaboration between TAs and faculty on designing worksheets, quizzes and tests should be viewed as part of the education of TAs about teaching.

Thus the exact details of a TA's responsibilities are at the discretion of the lecturer for the course. However, it is not reasonable for a lecturer to expect *all* of the above. Also note that it is not reasonable to require that TAs attend lecture; indeed, often their own classes conflict with the lectures for which they are teaching. In particular, if the lecturer needs a substitute, other faculty members are the appropriate source. In the rare event that an experienced TA is the best choice as a substitute lecturer, it should be considered as a special favor, not as part of the TA's regular duties.

1.4 Communication

The teaching team for a lecture section, that is, the lecturer and the TAs for the related quiz sections, is responsible for staying in good communication. If the students perceive that the lecture and quiz section are not coordinated, they are likely to decide that one or both are irrelevant or poorly taught.

Communicating with the lecturer before your first class is vital. See the tip list “Steps to Take Before the Quarter Begins” in Chapter 8 for more information about making this contact. Faculty should tell TAs before classes begin how the class will be organized (homework requirements, quiz and test schedule, grading scheme) as well as the faculty member’s view on the function of quiz section in the course.

During the quarter, the TAs should be notified *before* the students about changes in schedule, homework assignments, etc., and should know what is covered each week in lecture. TAs need appropriate advance notice of meetings to discuss the course or to grade; reasonable accommodation of the TAs’ commitments as graduate students should be made in scheduling these meetings. Faculty should make clear any preferences on grading, e.g. guidelines for partial credit.

Conversely, **TAs should keep faculty apprised of what material is covered in quiz section, and what student difficulties or misunderstandings are revealed there.** Scheduling conflicts should be communicated to the faculty member as soon as possible, preferably with suggestions of alternative times.

E-mail often provides the most convenient way of keeping in touch, but it also provides special opportunities for annoyance. It’s a good practice to send a brief reply to every substantive e-mail your lecturer sends you. For instance, if the lecturer writes to you, “please pick up the quiz for tomorrow from your box” or “what do you think of this problem for the midterm?” and gets no reply, she or he has no idea if you got the message or when you will act on it. A quick reply “will get it tomorrow before class” or “very busy today, will send you an opinion by Wednesday morning” reassures the lecturer and enhances your image as a responsible TA.

Email only works if you check it regularly. **We strongly recommend that you check your math-department email at least once daily.**

Another difficulty with e-mail concerns misinterpretation of disagreements and criticism. Comments made by e-mail rather than in person often seem harsh or disrespectful even when not so intended. **If you have critical suggestions, make an appointment to discuss them in person.** If someone else fails to follow this rule and sends *you* negative comments, be slow to take offence. Feel free to use the Lead TA or the TA Coordinator as a sounding board or intermediary, if needed, in responding.

1.5 Absences

Your students and your lecturer count on your presence at each and every quiz section so, barring a serious reason, you should not miss class. For instance, make sure that your vacation plans do not cause you to miss the beginning of the term — it is not OK to just show up a few days late.

In case something serious does occur, **it is your responsibility to arrange for a substitute TA at the beginning of the term, and to have the substitute step in if you will miss a class!** (this is one of the tasks in “Steps to Take Before the Quarter Starts”, Chapter 8.) If you know in advance, tell your students and lecturer who will be substituting, and make sure the sub has all the necessary information. In the rare case where it is truly impossible to get a sub, be sure to notify your lecturer and the Math Student Services Office (543-6830) as soon as possible, so they know what happened when student inquiries occur.

For missed office hours, arrange for a substitute or make them up at another time. You should always notify your students and lecturer in advance. You can reach your entire class via a class email list, which you should set up in MyUW at the start of the quarter (it may take 24 hrs to be generated). In an emergency, call the Student Services Office or the MSC and ask them to post a notice.

Chapter 2

Calculus and Precalculus at UW

We offer a number of different calculus courses to meet the needs of students with different backgrounds and goals. Your students may ask your advice about whether they should switch to a different course. This chapter gives you an overview of the 100 level math courses at UW, so that you can help such students towards the right choices. **Always tell students to check with an advising office (Math Student Services or Undergraduate Advising) before making changes in their schedules.** As a TA, you are not responsible for knowing all about prerequisites, distribution and major requirements, etc. These change rather frequently, and even faculty seldom know all the details; help the students avoid mistakes by telling them to check with an adviser.

The course sequences which most TAs teach include

- Business Algebra/Calculus, 111/112;
- Physical Sciences and Engineering Precalculus and Calculus, 120/124/125/126;

Although certain sequences are intended for certain majors, you often will find a mix of intended majors among the students in your course. For example, most business majors will be in the 111/112 sequence, but you will also find many psychology majors there as well. The sections of this chapter give more details on most of these sequences.

2.1 Course Websites

Every quarter you are assigned to be a TA, you should check the department web pages for information about your course. On the “Undergraduate Program” page

<http://www.math.washington.edu/Undergrad/>

(reachable by clicking on “Undergraduates” on the department homepage), look for your course under “Entry Level Courses” or “Syllabi of Selected 100 and 300 level courses”. (Your students can view these pages also; this is an additional reason to be familiar with their content!)

Math 111, 112, 120, 124, 125, and 126 have “Materials Websites”, available at

<http://www.math.washington.edu/~m111/>
<http://www.math.washington.edu/~m112/>
<http://www.math.washington.edu/~m120/>
<http://www.math.washington.edu/~m124/>
<http://www.math.washington.edu/~m125/>
<http://www.math.washington.edu/~m126/>

respectively (and linked to the department's webpage). The 124, 125, and 126 websites are organized into week-by-week quarter calendars and provide:

- information on textbook edition and homework software (Webassign),
- weekly worksheets,
- quiz/midterm/final archives, and
- miscellaneous comments and information.

The 111, 112, and 120 websites have materials that are of a supplementary nature (old exams, standard syllabi, study aids, etc.).

2.2 Math 111/112

Math 111/112 are likely different from the Math courses you've previously experienced. The content involves lots of similar concepts to those found in regular precalculus and calculus, such as slopes, tangent lines, exponential growth, areas under curves, and so on. However, less is covered from a technical standpoint (for instance, no trigonometry), and there is a heavy emphasis on applications to business and economics, and to problem solving using these ideas. The typical student who taking this sequence is the student in a major for which these ideas may be useful to know, but who will not take any further math classes.

The course introduces several techniques (especially in the realm of working with graphs using rulers) which might not be familiar. It also uses some language (terms from business and economics as well as some idiosyncratic vocabulary) which might be new to you. Many of the questions need to be answered with words instead of numbers or formulas. This makes some people uncomfortable at first, but most people find that they get used to it with experience. It is not uncommon to hear the following sort of tale from a student: "I asked my roommate/neighbor/older sibling/friend for some help. She/he is good at math, but she/he couldn't figure it out. This stuff is just too hard/weird!" We can't overemphasize the importance of reading and thinking about *all* of the chapters and *all* of the homework questions (both for the students and for the instructors!).

Math 111/112 used to employ a nontraditional textbook, written in worksheet-format by a UW professor. As of Fall 2012, a new textbook was adopted: "Mathematical Applications for the Management, Life, and Social Sciences", and the homework was switched to Webassign.

2.3 Math 120

Math 120 is the first part in our "Physical Sciences and Engineering Precalculus and Calculus sequence".

Many freshmen who have taken some calculus in high school choose or are required to take Math 120. One reason for this is the heavy emphasis on problem solving in the 120/4/5/6 sequence! In fact, it has been seriously suggested that we remove the "Precalculus" label on Math 120, and call it "Mathematical Modelling and Problem Solving" with a subtitle "Non-Calculus Based." (Math 124/125 would then carry the same title with the subtitle "Calculus Based.")

The learning-curve for problem-solving is particularly steep in the first 3-4 weeks of this class, which is when many students often become discouraged or frustrated. It is important to offer help and encouragement, and remind the students why this skill is so important. We emphasize problem solving skills in part to prepare students for further engineering and science courses. Before we introduced the current text ("Precalculus, A First Course in Problem Solving," by UW professors Dave Collingwood and K.D. Prince), anecdotal evidence suggested that students whose calculus instructors emphasized problem solving did better in their later engineering and science courses.

The content of the class involves standard skills needed to succeed in calculus such as functions, graphing skills, finding intersection points, solving quadratic equations, finding inverse functions, and trigonometry. The students who take this class are students who come to the UW who do not place into the standard calculus sequence. Most students plan to continue on to a major that will require a significant amount of calculus. Students need a minimum grade of 2.5 in Math 120 in order to be able to move on to Math 124.

2.4 Math 124/125/126

This calculus sequence is designed for engineering and physical science majors, but also serves as the "basic" calculus sequence. Thus you will find in these courses students majoring in biological sciences, business, and humanities. (Occasionally you even may find a math major!) You also will find that some students have already taken some calculus in high school, while others have no previous exposure to the subject.

The textbook we use is a custom version of James Stewart's "Calculus: Early Transcendentals, Seventh Edition." The subtitle "Early Transcendentals" just means that the rules for differentiating transcendental functions – such as trigonometric functions – are introduced earlier than they were in a previous version of the textbook.

In addition to the textbook, Math 124/125/126 students need a "WebAssign access code", since all homework is accessible and turned in online using WebAssign. They can purchase this code bundled with the textbook at the bookstore OR they can purchase a standalone access code which contains the ebook.

The typical collection of exercises for a section in Stewart begins with twenty or so routine problems, then continues with problems that require some setup, such as word problems. (Some sections, such as those covering integrations techniques, are predominately routine exercises.) **It is important for students to realize that the ability to complete the**

routine exercises is not sufficient for success in the course. For many, this is a major change from their previous math courses. While you cannot skip over the students' difficulties with routine problems, make sure you don't get bogged down every quiz section in the routine problems, thus neglecting the more complicated ones.

The Math 124 and 125 Materials Websites (see section 2.1 above) are designed in part to help keep the focus of the courses on significant problem solving. Another purpose of the sites is to make certain aspects of the 124/5/6 courses more uniform. Changing the quiz sections in Math 124 and 125 to be smaller (and therefore more numerous) and longer created a demand for more support materials for instructors, especially for the quiz section TAs. In particular, for classes with "long" (hour and a half) quiz sections, *faculty should provide all worksheets, quizzes and tests*, either by writing them or by designating worksheets from the website.

Math 126 is, in terms of mathematical content, much more of a change from high school math than 120/124/125 are. Here's a problem that illustrates one reason for this. In either one or multivariable calculus, one may pose the question, "What is the normal line to this [given] curve?" In one variable calculus, the geometric answer to the question is unique, and although there are many ways to formulate the answer in terms of equations, students tend to think of the slope-intercept form as "the" correct answer. In multivariable calculus, the geometric answer may fail to be unique, and no one formulation of the answer will always be preferable. Students find both kinds of non-uniqueness unnerving, and also have trouble with geometric intuition and visualization in more than two dimensions. There are a couple of models of the xyz -coordinate system around the department which can be helpful in class for connecting the two and three dimensional pictures. Math 126 also treats sequences and series, so that the students must deal with limits at a deeper level than in Math 124 or 125 or in most high school courses.

Part II

Basic Skills for TAs

Chapter 3

Using Black Boards, White Boards and Overhead Projectors

A good quiz section is both dynamic and interactive. The TA engages students through verbal discourse, worksheets, question-and-answer sessions, and presentations. Research indicates that more effective learning occurs when these activities are student-centered: a TA should focus on the student and not merely on the content covered.

This is especially true of presentations made at the board. The sad truth is that most students' notes capture only what was written on the board. In particular,

- What you write on the board is typically the only lasting guide the students have for understanding the material covered in quiz section; anything you say but do not write will probably not end up in their notes.
- What you write on the board serves as a model for the students in doing their own work. The quality of their exposition on homework, quizzes, and tests is unlikely to be better than what they see in the classroom.

Notice the potential contradictions here. If you fill the entire board in 15 minutes, the students are writing instead of thinking and interacting. On the other hand, the teacher may successfully lead a class discussion toward a crucial observation, but if the discussion is not documented, the students may not even realize its importance, let alone remember it.

Likewise, a carefully constructed, organized, and polished argument gives the students an excellent model for their finished work, but it may leave them with no clue how to start figuring out a problem. In contrast, a good record on the board of brainstorming and problem solving may leave the students confused about what is actually required for a complete answer, or even what the final answer is.

As with many other aspects of good teaching, you are faced with a balancing act. As a guide to understanding, you should include brainstorming, intuitive guesses, more explanation, pursuing ideas to their conclusion *even if they are wrong*, and alternative methods. Many students mistakenly think that being a mathematician means immediately knowing the final solution. Quiz section should help them to change this attitude: they should see how a (budding) mathematician works on a problem from beginning to end. These are some of the most valuable aspects of section which should not be sacrificed merely to produce a clear and logically organized board presentation.

As a model for exposition, you will want to produce a well organized, precise, and fairly concise finished product. (Occasionally, you may choose to accomplish this by preparing a handout for the next class, but don't go overboard on this. Students should learn to be independent enough so that they only need to have complete solutions provided occasionally. Your time is not well spent in producing a complete solutions manual.) Factors such as time constraints, whether you are discussing a new topic or reviewing for a test, what kind of questions the students are asking, etc., will influence how you balance these goals.

In addition to these generalized concerns, there are many practical details that can make your board work more useful to your students. Here are some suggestions.

3.1 Prepare in Advance

Before each term begins, **check your room**. (You will need to check a variety of things, including whether it has white boards, chalk boards or just transparencies. See Chapter 8 for more on what to check.) Write words in various sizes on the board. Walk around to various locations of the room to see if what you have written is visible and legible.

As a new TA, you will want to practice presenting solutions before your Quiz sections. Map out on a piece of paper exactly how you are going to structure the solution. (Better yet, do it on a blackboard somewhere!) If you've never taught before, you'll want to do this with several different problems before each section. Practicing on a colleague/friend is a helpful way of getting constructive feedback.

Even experienced TAs should sketch out in advance the diagrams for difficult problems. Can you convey the essential points of the problem in a simple to draw and simple to understand picture? If a complicated diagram is necessary, consider preparing it advance as both a handout and a transparency.

Remember, **the preparation described above is in addition to the preparation necessary to solve the problems on your own**. Being able to clearly and concisely present the solution to a problem is much more difficult than simply being able to solve the problem yourself.

3.2 Make Full Use of Your Resources

Begin class with a clear board. When you are first arrive to class, it is a good idea to erase everything that is already written on the board. Erasing everything in advance allows you to begin right away, and it takes away possible distractions. (Erasing everything is especially important when teaching mathematics, where stray lines may be interpreted as symbols.)

If your classroom has both boards and overhead projector(s), opt for the boards unless there is a strong reason to use the overhead. The noise of the overhead's fan and the bright light of the overhead right next to you both tend to distance you from the students. But the overhead may be the better choice if the available board is small or hard for the students to see. Even if you usually use the board, you may choose the overhead if you have a difficult picture or a lengthy problem statement that you want to write out in advance. (In this case, make a handout which duplicates your prepared transparency to give the students.)

If you use overhead projectors and your classroom has two, then use them both. You can switch back and forth between projectors, or you can reserve one projector for announcements, key formulas, theory, or anything you would like displayed throughout the entire class.

If the classroom has multiple sliding boards, use the boards in an order which maximizes the amount of used and useful board space on display for the students. That is, try to keep the most recently used boards in view; also keep in view any board with information you want displayed throughout the class period. (Figure out an optimal system and make a habit of it.)

3.3 While You Are Writing

- Write clearly and darkly enough so that your writing is easy to read from all points of the room. Don't be afraid to ask your students, "Can you see/read this?"
- Give the students time to write. Let students catch up with you periodically since they may be lagging behind. Pause and let them copy down what you have written. Before erasing the board make sure students have finished writing down the information. You might ask questions such as "Do you have this?" "Do you need more time to write this?" "Can I erase this now?"
- **Note that the inclusion in board work of English phrases and sentences as well as symbols promotes both understanding and good exposition!** One way of looking at this is to consider the writing on the board to be the TA's version of class notes. Every important point made verbally must also appear on the board. It can be abbreviated or even heavily summarized, but it must be denoted somehow. This will at least remind the student what was discussed during section, allowing them to fill in details later or perhaps ask for clarification.
- Avoid talking to the board. When you do, it's harder for the students to hear you. Some people are hard of hearing, and use lipreading (possibly subconsciously) to hear. Talking to the board also makes it harder for you to keep tabs on whether the students are following you, and creates the impression that you care more about what's on the board than about the students' understanding of it. Make your main points while looking at the students. Then it's OK to read aloud what you are writing on the board while you are writing; this makes note taking easier. It also has the effect of repeating points twice — you've made a point verbally, then as you write it down you are repeating the point a second time.

Stand at an angle as you write so that you have some eye contact as you talk about what you are doing. Facing the students increases your intelligibility, keeps students' attention, and conveys the impression that you are concerned about students' understanding of the material.

- Make effective uses of pauses. If many students are constantly writing, you should stop writing and/or talking to let them catch up. (If you switch from a chalkboard in one class to a whiteboard or overhead in another, be aware that *your* writing speed may change, but the students' speed has not.) In addition, you should stop periodically just to check student comprehension of what you have written. Ask if there are any

questions up to that point and if the presentation so far has been clear. Then wait. Teachers who have never timed their pauses usually wait 5 seconds or less for student responses. What might seem like an eternity to the teacher is typically a very small amount of time. Stand still and look at the class while you wait. This lets the students know that your question was not rhetorical and that you will not simply hand them the answer if they remain silent. A good rule of thumb is to interpret no response as meaning “I don’t understand.” By asking specific content questions (for example, “Why did we take the derivative with respect to t and not x in that last step?” or “What does it mean that h turned out to be negative?”), you can determine whether to continue, to slow down, or to go back and clarify previous items. You also give students a chance to think about the solution and understand it better.

- If you present the solution to a long, difficult problem, consider giving a summary at the end or asking the students what they would have done with a slightly different problem (“What would you do if this quadratic equation didn’t have any solutions?”). This shows your students that you’re teaching them how to solve problems, not just showing them the solution to one particular problem.

3.4 Create a Systematic Presentation

Follow a logical progression in the way you use the space on the board. Work from left to right. When the space is full, erase an entire section to avoid implying a connection between the new work and unerased work. It is good practice to ask students if they are finished with a section of the board before erasing it.

If you make any mistakes, stop writing, explain your mistake, and then go back and make corrections. Often it is better to cross out rather than erase a mistake: students then see more easily what they need to change in their notes.

Structure your board work:

- Use page and problem numbers. You certainly know which problem or chapter you’re working on, but the students may not, and certainly won’t remember later when they reread their notes.
- Isolate and identify the basic components of what you put on the board — this practice emphasizes and reinforces the structural aspects of the problem solving.
- Use underlining, capitals, and boxes to emphasize key statements, ideas and formulas.

The illustration on the following page shows a model for organizing material on the board that many TAs have found effective. You may develop your own plan or adapt this model to fit your own needs. Whatever you choose, it helps to be consistent in your organization so students know what to expect. The board is divided into three sections:

- 1) The section on the right is the largest; this is used for the major portion of the presentation, including diagrams, problem solutions, etc.
- 2) The section at the upper left lists the topics, problems, or examples you will cover (or from which you will choose what to cover).

Chapter 4

Working with Groups

Occasionally people have the misconception that group work turns the TA's job into a passive one. They think that all the work has been done beforehand and that the TA need only sit up front while a carefully orchestrated learning experience unfolds. This is not the case! **Facilitating group work is an active process.** Instead of monitoring a single audience, the TA must now keep tabs on anywhere from six to ten groups (or even more, if the students are in pairs). He or she must provide just the right amount of help and be willing to allow students to struggle through their own mistakes. Most of all, the TA must take an active role in fostering communication and cooperation within each group.

4.1 Believe in Group Work and Show that You Do

Be assertive. This applies to many aspects of running class. The students are looking to you for directions and guidance of what to do, how, and when. You're the teacher — they expect you to tell them what to do. Tell them to sit in groups, tell them to change groups, tell them to talk to each other. Some TAs worry about seeming pushy or authoritarian with the students, but the truth is that students EXPECT you to tell them what to do. Some TAs expect that students will come to class and be able to proceed with limited supervision and very little guidance of how to behave. This typically is not the case — students need help figuring out what they are supposed to do and how to do it. Students never give the feedback that their TA was too authoritative — the requests are always for more direction and more structure.

4.2 Getting Students into Groups

An important component of students working effectively in groups is their physical arrangement. In addition to telling them to work together, you will need to tell them (possibly several times) to rearrange the furniture to actually be together. This physical arrangement of the furniture and the students is a prerequisite to effective group work — it makes talking and sharing work possible. You will likely need to be insistent about this at the start, but they will learn and soon will do it spontaneously each day.

The process of moving chairs and bodies provides a clear start for the group work activity.

If you simply tell them to get started without having them move, then many may begin work on their own, others may talk or daydream. You may even wish to choose the groups yourself, either explicitly or through some random process such as counting off, or having students choose cards from a deck. (You must first carefully remove cards so that the number of cards equals the number of students. You should also choose the size of the various groups. After picking cards, the Aces join together as a group, the Kings join together, etc.)

Another technique that works well is for the TA to select the groups. On the first day you use a worksheet, you may just want to tell students, “You four are working together; your four are a group; you three will be a group, ...” This may save some time since you can avoid having students move around the room unnecessarily or waiting, unsure of which group to try to join. Later in the course, once you have some information about their scores on quizzes or exams you might try to balance the groups to make sure that all the “best” students aren’t in a single group. If you keep your grades on a spreadsheet as the course goes, it is very easy to sort the class according to their scores and use that list to create balanced groups. Another nice feature of selecting groups is that you can avoid having a single female working with three or four males (or vice versa), since that kind of imbalance can make the outnumbered person feel uncomfortable, leading to a poor group dynamic.

If you are assigned a classroom with fixed seats, you may request a new room from Math Student Services (especially if it is a week or more before the quarter begins). However, so many rooms have fixed chairs that you just may have to make do. Fixed seats don’t adversely affect pairs, groups of three function adequately, and even groups of four or five can still communicate if three sit in one row and the remainder sits just in front of them. Alternatively, some students may be willing to sit on the floor or work together up at the blackboard.

The first couple of times you initiate group work, the students should take a few minutes to introduce themselves, so that they feel more comfortable working with each other. It’s usually that first exchange of verbal communication that is hardest for shy students to achieve, but after that, they will have an easier time of speaking up.

4.3 Monitoring Group Progress

It is easy to get “stuck” talking to one group for an extended period of time. They may have lots of questions and you may have things you want to make certain they understand. However, it is very important that you divide your time wisely among the groups. When a group calls you over with a question, try to assess the situation: Is the whole group stuck, or is there a quiet member who probably can find the solution? How close are they to finding the answer? Will a small hint help? Do they need clarification on what the question is asking? Try to make your hints and clarifications short — just a few minutes — then quickly move on to another group.

Spending only a short period of time with each group is especially important at the start of the class. When you first set them to work in their groups, wait a few minutes and then make a complete sweep of the room, checking in with each group to make sure they are working and on the right track.

4.4 Using the Chalk Boards

Some TAs have found that having students work problems at the chalk boards is very effective. It eliminates some of the difficulties of getting students physically arranged in groups. By using the blackboard, all students in a group can see the work that's being done on the problem — not an easy feat when everyone is working in small print on their own piece of paper or even on one common sheet of paper. Using the blackboards often forces more interaction among group members, so that the work is more of a discussion. Having them work on blackboards also gives the TA the option of observing what the students are writing before intervening.

This blackboard system also creates some nice opportunities for whole-class discussion of solutions. If a group has a particularly good or interesting solution (or one with a nice error!), you can have them leave their work on the board and use it as the basis for a discussion or as a way for groups to check their work. Some students might want to copy down their solution on paper before the board gets erased.

Using blackboards helps students become comfortable presenting to the class as a whole. Students often report that this is fun and makes for a much livelier class atmosphere. It is certainly worth trying. Like anything else, students may resist at first. Commit to trying it for at least two or three classes and see what happens.

4.5 Getting Them to Ask Groupmates First

You need to get the students into the habit of relying on each other as much as possible and only asking you for help when they have exhausted all the resources in their group. Don't be too eager to answer students questions; give them a chance to work things out amongst themselves.

Always ask the person who called you over whether they had already asked all of the groupmates for help. If they haven't, tell them to only call you over if the entire group has discussed the problem and they still can't find a solution. Then walk away. This will give the less assertive group members more opportunities to participate, and it will train the students to only call you over when they are stuck as an entire group.

With groups (and also with individuals), you must be comfortable with a certain level of confusion. Being confused is a vital part of the learning process. Trying to rush students past their confusion denies them the time it takes to digest complicated concepts. Further, it can give them the false impression that mathematics comes easily to those who know it, rather than being something that everybody needs to struggle with. Experience will help you learn to distinguish “productive confusion” (i.e. the stage when concepts are just starting to come into focus) versus the confusion which results from being overwhelmed or from being “completely stuck”.

If too many groups are completely stuck (perhaps because the worksheet was too ambitious or because a key concept is missing), then you should consider making announcements to the entire class or perhaps “pulling the class together” (see below).

4.6 “Checking” Student Understanding

This is a highly effective means of interacting with your students. Essentially, “checking” involves making certain that each group has not only solved but also understood the solution to the worksheet problems. This way all the group members are encouraged to know and understand the solution. Having a student try to explain a solution is an excellent way for the TA (and the student) to get a sense of how well the student understands what is going on. Sometimes just hearing themselves speak, the students catch and correct their own errors.

Begin by telling the students to call you over when they, as a group, have completed one of the worksheet problems. You might do this with all of the problems assigned or just a subset — this technique is particularly useful when understanding an earlier problem is prerequisite to understanding a subsequent one.

When a group calls you over, ask one student to explain the first part of the solution to you. For instance, if the first part of the problem asks them if a particular function is concave up or concave down at a particular point, ask the student which it is. And then (this is VERY IMPORTANT), ask the student WHY that is the answer or HOW they got it. This opportunity to articulate the answer is crucial. Be friendly and conversational, but don’t let the student off with vague answers or handwaving. Ask why the answer isn’t such and such. When this technique is used well, the most frequently spoken words from the TA are “Why?” and “How do you know that?”.

After you are convinced that the student really understands the first part of the problem, ask another student to answer and explain the next part of the problem. (If the problem doesn’t have pre-designated sections, then subdivide it as you go along, asking for parts from different students.)

If the student you call on begins explaining the answer but then gets stuck, you can either give a hint to guide the student through the solution (thus modelling good problem solving) or you can ask if there is anyone else in the group who can help out. If the student called on first has absolutely no idea of what is going on, tell the group to call you over again when everyone in the group is ready to be “checked”. (Be sure not to embarrass the student called on.)

This whole process will take some getting used to on your part and on the part of the students. Alert them ahead of time. You might set some kind of guideline that each group must be “checked” on a certain number of problems each class. (You could use this as motivation for attendance and participation by making it count as part of their grade. Talk to your lecturer about the possibility.) This process is also time consuming and you may find yourself “stuck” with a single group for a long time. If this seems to happen, try “spot checking” by asking about just one or two parts of the problem before moving on to another group.

4.7 Getting Them to Talk to Each Other

Some of the students are going to take naturally to groupwork and talking to each other. Others won’t. In addition to specific techniques for getting them to talk (“checking”, asking all their groupmates for help before asking you, etc.), you may just need to tell them to talk. For some of them, even the idea of talking in class will seem strange. Encourage them by

talking in a normal conversational tone, not a whisper, when you talk to each group. You may need to remind them that it is not just OK but required that they talk. Humor can work here — “Hey, it’s too quiet here, I want to hear some noise” or “Math Talk! I don’t hear enough math talk!” or “Look! This is the opposite of a library. I will kick you out if you aren’t talking enough.” (Make sure they understand you are kidding about kicking them out.)

4.8 Getting Them on the Right Track

Avoid actually solving the problem when students ask “How do you do this?” Try to give a hint, get them back on track and then leave them to work on their own again. This is a good habit for several reasons. First, it takes less time. Second, it allows them to struggle with the solution more, leading to a better understanding. It also fosters self-reliance.

Giving good hints is not always easy. A good hint usually comes about when the TA has asked a student to explain the confusion and the TA has listened carefully and tried to understand what the student’s or group’s reasoning is. Then, the TA can decide what kind of hint to give based on students’ progress in thinking about the problem, and help them figure out where they went wrong or where they need to go next. Sometimes a TA is overly anxious to give the students the correct solution and denies the students the opportunity (and pleasure!) of finding that solution for themselves. A balance must be struck between leaving students “to struggle” and preventing them from becoming “too frustrated”. You want them to do as much of the work themselves as possible, but you don’t want them to feel so lost that they give up or feel that the group discussion was a waste of time.

4.9 Initiating a Whole Class Discussion — Pacing

One way to keep the various groups on track and ensure a certain amount of progress during a section is to have a planned pace. Tell your students “Work for ten minutes on this problem and then we’ll discuss it.” After the allotted time, have a brief whole-class discussion of the problem. If necessary you can give the solution yourself, but it is better to have students present their conclusions, with the TA moderating or perhaps giving hints.

If the different groups are proceeding at quite different speeds, another technique is to have a discussion “in the corner” with only those groups who haven’t finished a particular problem. This allows the groups to proceed at their own pace, as well as giving the TA freedom to move more slowly with groups who need it. The main danger in this is stigmatization — students or groups may feel singled out as being slow. To alleviate this, the TA should monitor the groups’ progress *without broadcasting the groups’ progress to the class*. As each group finishes a problem, the TA can quickly check their understanding. At the appropriate time, the TA can say something like “OK, every group that I haven’t gone over Problem 1 with, please come over here and we’ll do it together.” This way the students are singled out not by ability or what they accomplished but by the apparent circumstance of the TA’s actions.

4.10 Making Whole Class Presentations Better

The following tips are valuable for any presentation, but they are especially important for presentations given by the students themselves. Without this kind of interaction, student presentations tend to degenerate into a reading of steps. The key is to get students to articulate how they are thinking about the problem and the solution.

Talk about wrong paths:

When presenting a problem, I often begin by posing an alternative problem solving technique and asking students to explain why it works or doesn't work. Alternatively, when students are presenting a problem, ask them why they didn't choose a particular technique. For instance, by using dimensional analysis, it is easy to see that distance will equal velocity times time. Why isn't distance equal to acceleration times time squared? What about the case of constant acceleration? This sometimes sparks a good debate. Usually at least one student can articulate that dimensional arguments can't account for multiplicative constants.

This technique becomes especially valuable near the end of the semester, when the students have learned several problem-solving techniques. Just because a student chooses a correct problem solving technique doesn't mean that he or she understands why it works, or why other strategies do or don't work. Addressing these issues can lead to deeper conceptual understanding.

Often such a wrong path may be introduced with a question such as "Why isn't the answer just ...?"

"What if?" Questions:

When solving problems students often get wrapped up in the problem-solving mechanics and lose sight of the big concepts and intuitions. To fight this tendency, I often throw in a bunch of intuitive "What if?" questions while going over the solution to a problem at the board. For instance, a standard problem is to calculate which angle maximizes the distance a ball travels if it lands at the same height it was thrown. The answer is 45° . But what about a ball that lands at a height lower than that at which it was thrown? Or a ball landing at a higher height? The purpose is to make the students step away from the details of the calculation and think about either the conceptual background of a solution or the conceptual implications.

Skipping Parts:

As with everything, a TA must use his or her judgment in deciding how much time to give a particular problem or step to a problem. It is completely appropriate to decide to skip the early steps of a problem if you are certain that everybody understands them.

NOTE: This section was taken (in large part) from the "GSI Handbook" used at Berkeley to train their Math and Physics TA's.

4.11 Closure

A real danger with in-class group work is that students sometimes leave without *closure*. That is to say, they may leave without knowing if they had been working in the right direction with valid methods, or without seeing how the work they did fits into the bigger

picture of the course. The latter problem can be especially big with “discovery projects” such as worksheets that ask the students to, more-or-less, discover mathematical principles.

For example, there is a worksheet that is often used for Math 124 that asks students to compute the instantaneous velocity of a ball where its position is given by a particular function of time: they are guided to compute the average velocity over a small increment of time and then to compute the limit as the length of the time interval shrinks to zero. To those of us who already know calculus, we immediately see that the idea of a derivative is being introduced, even though that topic has not been mentioned in lecture or the textbook yet. The students are being guided to discover the idea of a derivative on their own. But without our perspective, they may not see how this problem fits into the overall scheme of the course, and they could leave class feeling like they wasted the entire time on a contrived problem about which nobody cares.

The TA really should to spend the last few minutes of section discussing with the whole class how this worksheet problem fits into the big picture of calculus. Doing so serves several purposes, including

- making sure students see the importance of the calculations they just performed, and
- making sure students don’t think your quiz section is a waste of time.

The second item here is very important, even though it may seem superficial at first. The fact is, students learn more when they appreciate their learning experience, because they are not distracted by their complaints.

Closure can take a variety of forms. After students have finished the worksheet, the TA can lead a class discussion, asking students questions such as, “What have you learned from this project,” or “Can you imagine other circumstances under which this procedure would apply?” Sometimes there is not enough time left at the end of class for such a discussion, so the TA might just spend one or two minutes explaining to the class how the worksheet fits into the big picture of the course. The important thing is that *some kind of closure must be given* to guarantee that students will understand and appreciate the worksheet and the time they spend in your quiz section. Note: just giving out the final answers is not closure.

Students who finish the worksheet early may want to pack their bags and leave. Providing closure will probably require you to ask them to stay. *Don’t be shy about this!* Just tell them (pleasantly, without “ordering them around”) that there will be a discussion at the end of class for which they should be present. You may even want to tell them that they should check their solutions so that they can present them to the class (which would be an excellent component of a closure to the days’ activities). If you set this expectation at the beginning of the course – that everyone will remain in class until the closing discussion is finished – students will come to accept it (despite any initial grumblings they may have). They will probably even come to appreciate the fact that you care if they are there.

Chapter 5

Advice for Grading Math Problems

Most teachers consider grading to be the most tedious and unpleasant of their duties. This is ironic since the students often consider their final grade to be the most important aspect of the course. If you have never graded before, you may be shocked to realize how subjective grading can be — even in a subject as “cut and dried” as mathematics. Grading is really more of an art than a science and there are many different grading styles out there. Below are some key points which may help you get started.

Your three main concerns while grading will be **fairness**, **consistency** and **efficiency**. A fourth concern which comes into play during grading and while handing back tests is providing feedback for the students.

5.1 Establishing a Grading Scheme

The most important tool to help you achieve fairness, consistency and efficiency is a good grading scheme (sometimes called a “rubric”).

In principle, there are two different ways to score a problem. You may begin with a score of 100% then deduct points for each deviation from a “perfect” answer, or you may begin with no points and add points for each “correct step” towards the right answer. Choosing between the “top down” and the “bottom up” method is somewhat a matter of taste, but different questions are better suited to one method or the other. It’s worth noting that the two methods seldom meet in the middle! If a problem includes many small steps of computation and you deduct for each minor error, or if a student shows understanding of only a small part of the solution, “top down” will probably give a lower score than “bottom up.” With other problems or other students, “top down” methods will assign higher scores than “bottom up” methods. In general a pure “top down” scheme is best suited to a problem that is very straight-forward, with many students getting near perfect answers. (A very poor student may end up with a zero in this situation, even though he or she did a few steps right; but that may be very appropriate grading if the skills involved should be, by that time in the course, routine.)

The best grading scheme for most problems you will be grading is probably a mixture of the two methods. First assign certain point amounts awarded for specific steps – making it “bottom up” in this respect. Within a particular step, it’s often easier to grade “top down”. For instance, you might deduct a single point for a computations error, or half the

step's points for a certain common error, etc. It's also a good idea to identify likely incorrect approaches and give them a predetermined amount of partial credit – this could be viewed as either “bottom up” or “top down.”

Here's a somewhat idealized outline of devising a grading scheme. You may not choose (or have time) to do all these steps every time you grade, but this gives an idea of the kinds of considerations you should make before and during grading. This is how I establish my grading schemes:

Step 1: Do the problem.

There are very few instances when you can safely skip this step. Write up your own solution to the problem carefully and methodically. Make sure you do the computations correctly. Can you think of alternative methods to do the problem? With experience, you'll even be able to guess some common incorrect approaches to the problem.

Step 2: Assign point values.

Some problems are already broken down into parts. Some parts may already have points assigned to them by the lecturer. Break down these point assignments even further. (For example, part (b) may be worth 5 points total, but you decide that choosing the correct formula is worth 2 points, finding the correct input values is worth 2 points and doing the calculation correctly is worth 1 point.)

As long as you are consistent, you may use some “subjective assessment” in determining how points are assigned. For example, in a correct solution the step of finding the right formula may be worth four points, but if somebody simply writes that formula down without applying it and without demonstrating any understanding of what it means, then this might only be worth two points or perhaps no points at all. For example, if the students are allowed notes and the “stock formula” is written in terms of x and y , but the test problem is posed in terms of u and v , no points should be awarded for simply writing the stock formula in terms of x and y .

Usually, you should award more points for understanding and fewer for computations. For instance, in a ten point problem, you might assign only one or two points for making the correct calculation, and give the majority of points for determining the correct approach and correctly interpreting the input values. This distribution of points is consistent with the emphasis our courses put on modelling, problem solving and geometric understanding. (Of course this does not apply if you are giving a quiz on computing derivatives or integrals!)

Step 3: Examine Some Tests

Now that you have some tentative point assignments, try grading some papers. Do they fit into your grading scheme or are students approaching the problem in a completely different way? Do the point totals seem too high or too low? Are they “fair” for the work you see on the page? Does a paper with a 50% score seem to deserve it? If the scores don't “seem right”, then you might want to adjust your point assignments to give fairer scores.

Occasionally, while looking through the papers you'll find a correct approach which you hadn't considered. More often, you'll find several incorrect approaches which you hadn't imagined. These might need to be “appended” to the grading scheme (e.g. 50% credit if some particular wrong approach is executed with correct technique). You may need to

look at ten or more papers before you settle in on a scheme which seems to cover all the possibilities.

Step 4: Revise the Scheme as Necessary

Every time you find a “bizarre” solution which doesn’t fit the scheme, make note of it (and how many points you assigned) on your written scheme. You’ll be surprised how many times the same approach will pop up on a different paper. If nothing else, your catalog of partial credit will help keep you consistent while deciding how much to award some other unique approach. It may also help you recall your thought process when students ask you later about the grading.

5.2 While Grading the Test

While a good grading scheme makes the job much easier, there are a couple of other things to keep in mind while grading.

Grade Similar Solutions Together

We strongly suggest that you grade the tests one question at a time. For example, if a quiz has two questions, first grade all the students’ answers for question 1, then go back and grade all the students’ answers for question 2. There are two main reasons for this: Your grading will be more consistent because you will have an easier time remembering how you graded similar mistakes; and your grading will be faster, and less painful, since your brain will not have to keep switching gears between the various problems.

This principle can be carried further. When you are faced with a problem that is particularly difficult to grade (perhaps because there are multiple approaches, or because you want to give partial credit to students who made significant mistakes near the beginning but did meaningful work afterward), we suggest the following: First make a quick pass through all the students’ answers. Lump them into three or four piles from near perfect to near zero. Grade the near perfect pile, then the near zero pile (these are the two easiest piles) and then attack the difficult answers that are “in the middle”. The extra familiarity from having graded a bunch already makes grading these middle ones easier. Also, making partial credit decisions and maintaining consistency are easier when you see similar quality papers at nearly the same time.

Even when grading a large number of papers, for example a common final, it is helpful to split the first batch of twenty to thirty papers into piles of similar quality then grade each pile together, as above. By the end of this process you will have a better grasp of your partial credit scheme and you may then take the rest of the papers one at a time.

Keep Check on Your Fatigue Level and Your Emotional State

Grading can be tiring. In addition, you might find your first year in graduate school to be a challenging experience. Make sure you don’t take out your frustrations on your students! Chances are that you will see the same “dumb” mistake time and time again. The twentieth time you see the same mistake (perhaps the one you warned them three times not to do), you may get furious. Remember, **each student only made the mistake once**. Grade consistently. At the opposite extreme, the first time you see a mistake, you might think the

person is brain-dead and penalize them heavily. The fifth time you see the same mistake, you might think “Oh, that isn’t so bad. Everyone is doing it.” Again, grade consistently. Sometimes you realize that an approach isn’t so farfetched after all, it only looked strange the first time you saw it; or perhaps the third person to make the mistake did a much better job explaining his or her thought process. In this case, you may need to go back and change the earlier grades. You must stay consistent. A well-designed and comprehensive grading scheme will help you avoid “grading drift” over the course of a long grading session.

Fill in Blank Space (To Prevent Cheating):

This is especially important while grading midterms and the final. If the back of a sheet is blank, or if an entire section is blank, cross out the area with a red “X”. (If you do this quickly, you might make an α instead; this is the department’s accepted “blank space” symbol.) If a large area has just a small amount of writing, then box in the writing in red and put an α into the remaining blank space. You may also want to put a horizontal line below a student’s work to indicate where he/she stopped.

This only takes a few seconds and is vital to prevent cheating. Many cheating attempts come after the exam, when students add something to their solutions and try to convince their teacher that it was there all along and the grader just missed it. Filling in the blank space is the best way to prevent this, short of copying every exam before handing them back (which just isn’t a viable solution).

Recording Scores:

It’s usually more efficient to alphabetize papers before recording scores. Recording and checking scores goes very quickly when you do this. Also it’s easier to locate a particular student’s paper, say if the performance was unexpectedly good or bad. (When handing the papers back, vary the order: don’t make the people whose names begin with W through Z always get their papers last!)

To alphabetize efficiently, you can break them into about four or five piles: “A-C”, “D-G”, etc. This goes quickly. Then alphabetize each of the five small piles by hand. On a large table, or the floor, you can spread each pile into a column (so all the names show) to make alphabetizing easy.

5.3 Giving Feedback to Students

Ideally, every incorrect solution would have a paragraph from the grader explaining just where the student went wrong. Unfortunately, this would take a very long time. While some solutions deserve short notes, writing too much detail is not an efficient use of your time. However, there are some effective ways to give feedback which aren’t time consuming.

Where did they lose their points ?

Mark with a fraction where they got credit and where they missed (for instance, a ten point problem might have two parts marked $3/4$ and $4/6$). On some solutions, you might indicate “OK up to here, below incorrect”. You may even give students an edited version of your grading scheme, BUT BEWARE — make sure you modify it so that the students understand everything on the scheme (omit parts which are not relevant to most students)

and make sure that the students understand that it is *your* interpretation of the scheme which determines their grade, not *their* interpretation. By giving too much detail in the scheme you invite the “classroom lawyers” among the students to start second guessing your decisions of how the scheme applies to their papers. If you find this happening too often, then give fewer details or stop giving out the scheme altogether.

Helping students learn from the test

Writing corrections on each paper takes too much of your time; working the entire test in class takes too much class time. To make best use of the limited resources for presenting corrections, keep brief notes as you grade on the most common errors, and share these with the rest of your teaching team. Talk with your lecturer about providing a solution sheet (perhaps on the class web site). Supplement the solution sheet with brief written comments on papers and class discussion of the most serious or common mistakes.

Chapter 6

Office hours and the Math Study Center

You are expected to hold at least two scheduled office hours per week, and make appointments as necessary to meet students who have time conflicts with your scheduled hours. According to *Teaching and Learning at UW: A Handbook for New Teaching Assistants* (published by CIDR; 1998 edition, p. 13), “At the University of Washington, it is typical for TAs to offer at least three office hours a week.” By including appointments and some extra office hours and/or review sessions before exams, your average over the quarter should work out to be about three hours a week. If the course you are teaching is served by the Math Study Center (MSC), some or all of your office hours will be held in the MSC. If you have a “split” assignment with one quiz section and several hours as a “tutor” in the MSC, see section 6.4 below about your office hour requirements.

6.1 Scheduling and Announcing Office Hours

Check with your lecturer before classes begin, to find out if she or he has conditions on your office hour times and locations. You may want to set only temporary office hours for the first week of classes, and set hours for the rest of the quarter after balancing various considerations. The teaching team should have, as much as possible, non-overlapping office hours so that students have as many hours as possible in which they can see someone associated with their lecture. If holding office hours in your office, coordinate with your office mate(s), so that office hours overlap as little as possible. Tell your students what times you are considering for office hours, and check how many of them have conflicts. You’ll seldom be able to avoid all conflicts, but you don’t want too many: the students won’t appreciate it, and you’ll end up making lots of appointments to supplement scheduled hours. (It can easily happen that 3/4 of your class has chemistry lab right after math quiz section, so that even if that time is ideal for you it is useless to most of your students.) You can do this in class, or you can make an online poll in Catalyst (log into <http://catalyst.uw.edu>) that gives students a short list of times and asks them to check off whether they have a conflict at that time. Scheduling office hours for Monday or Wednesday evening (or Tuesday or Thursday morning, if you have an afternoon section) — especially before the section when homework is due or a quiz is scheduled — gives the students a time to ask last minute questions, and it probably will provide you with good insights into what topics or problems to prepare for class.

Many freshmen are not used to the concept of “office hours”. Explain to them how valuable this one-on-one or small group assistance can be. Make sure they understand that coming to office hours is *not* the mark of a bad student. You might also point out that a college class covers much more information in one period than a high school class does, so some student-teacher contact needs to occur outside of class, in office hours or the Math Study Center.

Announce your office hours several times in the first few weeks, writing them on the board and/or on a handout that you make sure everyone gets. Remember that students may add the course late or attend quiz section irregularly. Throughout the quarter, but especially before and after tests, remind students of your office hours and of ways to make appointments (email, seeing you before and after class). In addition to being helpful to students, this may improve your student evaluations. There’s anecdotal evidence that the students’ perception of your availability is related as much to their awareness of your office hours as to the number of office hours you hold.

6.2 Your Office Hours Style

Just as there are a wide variety of formats for holding Quiz Section, there are a wide variety of teaching styles that can be employed during office hours. Most TAs act as a kind of tutor, working one-on-one or with small groups — gently leading students to the solution of a problem.

Your office hours are a good chance to use the “Socratic Method” of teaching by asking questions. One TA I know would write nothing at all on the board during his office hours. Instead, he would sit at his desk and ask quite general questions — “How do you think you should approach the problem?”, “Is there any other information you have been given?”, “Does this method work in general?” — while the students wrote at the board. It takes a firm resolve to use this style and progress often seems quite slow, but in addition to a solid understanding of the material the students gain confidence in their own ability to do problems.

If you have good attendance at your office hours, you probably should work with students in groups, rather than individually. For groups of five or less, I usually keep a single group, with the students each asking one question in turn. I first try to get other students in the audience to answer the question before explaining it myself. For more than five students, you should consider breaking the students into separate groups.

6.3 Holding Office Hours at the MSC

TAs for Math 111/2 are required to hold at least two office hours a week in the MSC, and TAs for Math 120/4/5/6 are required to hold at least one office hour a week in the MSC. (TAs for these courses are encouraged to hold all their office hours in the MSC, but only one is required.)

At the MSC, you are welcome to give top priority to your own students, give next priority to other students in your lecture section, then (only if you wish) help students in other sections of the same course. If no students from your course need help, you may, if

you wish, help students from other courses, but only if you are acquainted with the material (e.g., if you've taught that course before). You may reserve one of the cubicles at the MSC for your office hours, or move into one if working with a group of your students or a private conversation requires it. (Note that the cubicles have white boards. Please see Dr. Conroy to reserve a cubicle or the conference room.)

There are many advantages to having office hours at the MSC. Students have many sources of help there: not just you, but other students in the same course and other TAs and undergrad "tutors" working at the MSC. Some students use the MSC as a study hall, doing homework and getting help when they're stuck; this is more productive than working alone at home and piling up questions to ask the next day. You may get a better idea of what concepts and problems are most difficult for students by seeing what all the students, not just yours, are struggling with in the MSC. When your office hour is over, the MSC usually is still open, so you can leave in good conscience even if some of your students still have questions. If your students need help when you don't have office hours, they'll probably go to the MSC instead of coming to your office asking "May I have an appointment *right now*?"

If you hold all scheduled office hours in the MSC, be especially careful that your students know they can make appointments to see you privately or in small groups. These meetings may be in your office; or at the MSC, you can use the cubicles and sometimes the conference room next to Matthew Conroy's office. Remind the students several times throughout the quarter that it's easy to make appointments to see you outside of scheduled office hours (especially if they have conflicts with all your office hours). For instance, after midterms is a particularly good time to do so, when many students may need some individual, possibly confidential, attention.

When you have decided on your office hours in the MSC, notify the MSC front desk. You can do this the first time you come in for office hours. If you will be in a cubicle, indicate which one. If you change or miss an MSC office hour, please notify the front desk (685-4714). They need this information in case students come in looking for you.

If you find that the MSC doesn't work well for office hours for you and your students, an exception to policy may be made if *all* the following steps have been taken.

1. You've tried office hours in the MSC, and have specific reasons why you think holding all your office hours in your office would serve your students better.
2. You've talked with Matthew Conroy, the head of the MSC, about possible changes in the way you use the Center to solve the problems you experience working there. (For instance, would you do better in a reserved cubicle or at a central table? with a larger/smaller cubicle? at a different time?)
3. If no adjustment can make office hours in the MSC serve your students well, ask your lecturer for permission to hold all your office hours in your office. If she or he agrees, tell your students, the rest of your teaching team, and the MSC that you will be in your office instead of the MSC.

6.4 Assignments to the MSC (including Split Assignments)

Some TAs are assigned to the MSC, either as their full TA assignment or in combination with teaching one quiz section. Such TAs are referred to as MSC “tutors”, even though the MSC does not provide one-on-one tutoring. A full assignment is twelve hours a week, and a “split assignment” is six hours in the MSC plus responsibility for one quiz section (which includes one additional office hour for your students, not included in the six you work for the MSC). Ordinarily, a TA should have experience with several of our courses before being assigned as a tutor.

Split assignments present special challenges. The following guidelines should help you manage the two roles you have in such assignments.

- During the six hours working for the MSC, your own students have no special priority. Help students in order according to the MSC system (raised hands or signup sheets).
- In addition to those six hours, you must hold at least one office hour a week for your own students. You are encouraged to hold that office hour in the MSC, possibly in a cubicle, to make giving priority to your own students easier. (If you TA MATH 111 or 112, you will be required to have one office hour in the center.) You are also encouraged to hold a second office hour for your students (in the MSC or elsewhere).
- All TAs should provide many ways for their students to connect with them, but this is even more important if you have only one scheduled office hour. If possible, get student input into the choice of the one office hour. Remind students frequently of ways to make appointments — email and talking with you before and after class. Tell them which of your MSC tutoring hours are least busy, so that you are more likely to be able to talk with them. You also might consider having a “drop-in” time when you are usually in your office and likely to be able to make an appointment on short notice.

6.5 Some Potential Problems and Solutions

Problem 1: Students don’t use office hours even though many need extra help.

Suggestions:

- Remind your students *frequently* of the time and location of your office hours. Some TAs start every class by writing TA name, email address, office location, and office hours on the board. You should at least do this before and after every test.
- Repeat your explanation of the role of office hours, as discussed in section 6.1 above.
- You might write “Come see me during office hours” on a poorly written quiz or exam, then use the time to go over the problems. This would be especially helpful if you have identified a repeated stumbling-block for that student, such as using the chain rule incorrectly or a particular algebraic mistake. Occasionally students are really turned around by this. Sometimes they aren’t taking the class seriously because they feel

anonymous. Coming to an office hour and seeing your interest might change their attitude.

Problem 2: One or two students ask for appointments outside of office hours too often. You want to help, but you don't feel that you can spend this much time on individual students.

Suggestions:

- You can encourage those students to come to the Math Study Center more often. If they don't like that suggestion, then you can encourage them to create a study group with a few of their fellow students. If they insist that they need one-on-one attention from somebody who fully understands the material, you might (tactfully) suggest they hire a tutor. The Math Student Services Office has a list of potential tutors.
- Let your students know that you are also a student carrying a full load. Some of them may think you are a full-time teaching assistant.
- If you are worried about "run-on" appointments, you can schedule your appointments so that you have a concrete obligation (e.g. a class or a bus to catch) for which you must leave after, say, thirty minutes.

Part III

Tips and Special Topics: Getting Started

Chapter 7

Top Tips for New TAs

Everybody has a different teaching style. Some things work for some people, but not for others. However, there are certain basic principles which underlie any effective style. Here are some tips from our seasoned pros about how to get your teaching off to the right start.

1. **Be prepared.**
2. **Be enthusiastic.**
3. **Be professional.**
4. **Develop a personal relationship with your students.**
5. **Vary your teaching to reach the variety of students in your class.**
6. **Accept your mistakes.**
7. **Realize that you are one part of a teaching team.**
8. **Realize that the student is ultimately responsible for learning.**

And now in detail . . .

1. **Be prepared.** Nothing will undermine your confidence in yourself and your students' confidence in you faster than an obvious lack of preparation. Doing something at the front of the classroom usually takes much more preparation than doing it alone. Even experienced teachers presenting very basic mathematics and easy examples can get confused at the board if they haven't worked through the ordering of the ideas and the details of the computations. It's also important to have your materials organized, so you aren't constantly fumbling to find what you need in your backpack.
2. **Be enthusiastic.** Students respond to your energy level. If you see teaching as drudgery they will pick up on it and ultimately make your job a much more difficult one. For the one-to-three hours you teach section, put your personal life aside. Put aside the difficulties you are having in your own courses. Bring excitement into your classroom. This is at least as important as polishing your mastery of the material. In the long run, feeling good about your teaching will give you more confidence and

energy to do your own coursework. Learning mathematics at the graduate level can be stressful and is often filled with ups and downs. As you progress into your own research, the ups and downs simply become more pronounced. Good teaching can be a stabilizing force, allowing you to stay positive even when your proofs fail, your counter-examples spring leaks, or your programs won't run!

3. **Be professional.** Avoid “cheap” ways to make contact with your students. I once heard a TA (at a different school) make a casual remark about drug use to his students. No doubt some of his students thought this was “cool” and it helped him build a rapport with those students. But others might have been offended. It easily could have undermined his authority with many of the students. As a TA you are representing the University. You are allowed to be an individual and you are allowed to have opinions, but the image you project to your students is a **public image**. Make sure it is an image you can be proud of.

Dress well when you teach. (I doubt you will see any TA wearing a suit, but pick out a clean shirt and nice pants/skirt.) Many of us don't care at all about how our teachers dress, but some of our students do. Why create an uphill battle to gain their respect? And try to avoid clothes that will distract your students (by being too tattered, too revealing, or too covered in slogans).

Finally, do your best job. Being a TA is an important part of graduate school. Most quarters, it will supply your funding. Take it seriously.

4. **Develop a personal relationship with your students.** Learn your students' names by the second week of class. (You can view a roster of your students with pictures on <http://myuw.washington.edu>). Use their names whenever you can. Follow their progress — take note of how they do on tests, remember which concepts they found difficult but ultimately mastered. One aspect of being a good teacher is being a coach. You must motivate your students to try their hardest. You can't effectively motivate them if they don't think you care about them.

5. **Vary your teaching.** Every class represents both a range of ability and a variety of learning styles. Too often, teachers get trapped by teaching to whatever learning style they possessed as a student. They will often teach at the level which they imagine represented themselves as undergraduates. It is easy to lose perspective on your level of understanding as an undergraduate. In hindsight, most people overestimate how much they knew. Further, as graduate students, your “undergraduate selves” do NOT represent the average undergraduate student. It is important that we don't simply teach to the “copies of ourselves” in the audience, while we ignore all the other students who would benefit from a different level, pacing, or style of presentation.

Make sure that you aren't simply teaching to the top ten or fifteen percent of your class. Include a variety of activities so that everybody will benefit from at least some of the class time. Some people find visual images essential for learning, others need to have a complete worked example to study, or a chance to rephrase the idea in their own words. Make sure you employ some method to determine whether your class actually understands the material you are presenting. Don't allow the few students “at the top” to dictate the pace of the entire class.

6. **Accept your mistakes.** None of us is perfect. You will make mistakes. The important thing is how you handle your mistakes.

Students can easily ask questions which are beyond what you are expected to know. Occasionally, you might be stumped on something you “should” know. Don’t let this fluster you. It is always acceptable to answer “I’ll have to take some time to think about that. I’ll give you the answer next section.” Be sure not to try to “cover up” your ignorance and **never** “make up” an answer just to have something to say. You are not expected to be the ultimate expert on all things mathematical. Be comfortable with your limitations.

Never hide your mistakes. If you previously made a mistake *make sure* that every student understands why it was a mistake and how to correct it. You can turn it into a positive experience by reinforcing that the material can be quite difficult and, yes, you are human as well.

By successfully handling these difficult situations, you will gain your students’ trust and respect. You will lose their trust and respect either by trying to cover up or by not correcting your shortcomings or mistakes.

- 7. Realize that you are part of a teaching team.** Work together with your lecturer. Coordinate quiz section with lecture so that the two complement each other. Work with the other TAs teaching the same course, especially the one (or more) with the same lecturer. Take advantage of the materials (quizzes, worksheets, etc.) that other TAs have prepared. Make materials you prepare available to the larger community.

NOTE: Another “cheap” way to develop a rapport with your students is to denigrate something: the textbook, the school, the Math Study Center (MSC), or even the lecturer. Avoid this at all costs! Most TAs wouldn’t speak ill of the lecturer, but a student who, for whatever reason, is upset with the lecturer or the text will occasionally complain to you. They are looking for your implicit or explicit agreement with their negative assessment. Do not give it to them! Shift the focus. Say “I know this is really hard material. Everyone presents it in a slightly different way. I’m sorry if Prof. X’s presentation doesn’t work for you. (-or- I’m sorry if text Y isn’t clear for you.) Let’s examine some ways you can get more out of lecture.” Some possible ways would be: reading the text before lecture, reviewing notes ASAP after lecture, using office hours with the professor and/or you, using the MSC, forming a study group. Similarly, if the students complain about the MSC, **do not** validate their negative impression. Say “Yes, it does get quite crowded there sometimes, but there is a usage chart on the wall which shows you the times that it is not crowded.” Or, “I’m sorry if the TA there didn’t seem helpful. The goal is not for the TA to do the problem for you, but for the TA to help you figure out how to do the problem.” Or possibly, “I’m sorry you had a bad experience. I know that most of the TAs there are quite good. Ask your friends whom they have gotten good help from.”

- 8. Realize that the student is ultimately responsible for learning.** This is actually a great complement to our fourth tip, “Develop a personal relationship with your students.” Eager TAs easily can get upset when their students don’t do too well. This is not appropriate. Realize that their performance is not a direct reflection on your teaching skills.

It can be especially frustrating when you have explained an important point three times and many students still get it wrong on the test. (While you certainly should double check that you made your point clearly, don’t get discouraged.) Rather than getting angry, rather than anguishing over finding a way to pound the point into their

heads, you should relax. Your duty is to do the best job you can teaching. A good teacher provides an environment that facilitates and motivates student learning. It is the students' job to do the learning, the teacher cannot do it for them.

A mathematics teacher can light the lantern and put it in your hand, but you must walk into the dark. – *attributed to William H. Armstrong*

Chapter 8

Steps to Take Before the Quarter Begins

Your teaching assignment (course and rooms) will be put in your mailbox in the lounge and/or e-mailed to you, a few weeks before classes begin in the Fall and before the end of the previous quarter for Winter and Spring. (After your first quarter, you will be asked for your teaching preferences before assignments are made.) Before the quarter begins, you should do the following.

1. **Contact your lecturer.**
2. **Get the textbook(s) and look over the course websites.**
3. **Check your assigned classrooms.**
4. **Arrange for another TA to substitute in case you are sick.**

Read on for more details.

1. **Contact your lecturer.** For the Fall quarter, contact your lecturer as soon as you know your assignment. To reach your lecturer, it's best to send an e-mail. Most Autumn Quarter 124 and 125 lecturers visit TA training to meet with their new TAs.

Ideally, the week before classes begin, you will already have met or at least made plans to meet with your lecturer. Sometimes this is impossible because the lecturer is out of town. In this case, the lecturer should either e-mail you or leave information with the TA Coordinator or the Math Student Services Office about when you can meet, and what you should be preparing for the first week of classes. If you do not hear from your lecturer, you should take the initiative to email the lecturer about when you will be available to meet (including on the first Wednesday of classes, before your first quiz section on Thursday). Meanwhile, figure out some review or diagnostic work for the first quiz section, in case your lecturer does not specify anything by that time. Your mentor can help you with this if you are a new TA.

After your first year, you may be out of town right before Fall Quarter begins. In this case, try to talk with the lecturer before you leave. If you're not successful, send an email telling when you will return, and check your UW email while out of town. If

you leave town before you are even given an assignment, then tell the Math Student Services Office when you will be back. *Ask them to tell your new lecturer when you will be returning.* You can also ask the Student Services staff about your assignment using e-mail. You should remember to continually check your math e-mail when out of town for updates from your lecturer or your assignment.

For Winter and Spring, you should talk with the lecturer before the previous quarter ends. If for some reason this is impossible and you will be away during quarter break, then leave your lecturer a message detailing when you will return, and check your UW email while away. Meet with your lecturer as soon as possible after you return.

The lecturer will want to know your office hours, and may have instructions for you about what to cover in your first quiz section. You will want to ask:

- When is homework to be assigned?
- What is the grading scheme for the course? (The students will be asking you!)
- What is the schedule of quizzes and tests, and how is the responsibility for making, proctoring, and grading them to be divided among lecturer and TAs?
- Does the lecturer have guidelines for what you do in section? For example, “Your top priority is to answer their questions on homework” or, at the other extreme, “Don’t answer questions on homework during Quiz Section.”

2. **Get the textbook(s)** for the course from the Math Student Services Office (C-36). **Look at course information on the web.** (See section 2.1.) Look at sample midterms and finals in the textbook or on the web. What skills and understanding do your students need to have by the end of the quarter?

3. **Check your assigned classrooms**, and the commute between them. This means both find them (so you aren’t late to your first class) and make sure they are acceptable. Is the room big enough for the class but not way too big? If you will ask the students to work in groups, is the seating (e.g. fixed or mobile) conducive to forming groups? Requests for classroom changes should be made to Math Student Services as soon as possible, preferably at least several work days before classes begin, or after the first week of classes. Also check whether you will need chalk, overhead pens, or whiteboard pens, and how large your writing needs to be. Suggestion: write words and numbers in various sizes on the board, then walk around the room to see if what you have written is legible. Consider glare and lighting factors.

Room assignments are often changed! The most up-to-date information for math class room assignments is available from Math Student Services. The on-line Time Schedule and MyUW usually are correct, but can have a one-day lag in posting changes. It’s wise to double-check the day of your first quiz sections, to find out if you have been moved! The easiest way is to check on-line at

<http://www.washington.edu/students/timeschd/> .

If your classroom has been changed within the last week before classes start, or if it is changed after classes start, post a note on the door of the old classroom informing students of the room change.

4. **Arrange for another TA to substitute in case you are sick. *This is very important!*** Pair up with another TA who teaches at different hours than you and agree to substitute for each other in case of illness or emergency. When you are sick with the flu or stuck on the other side of Snoqualmie pass because of a snow storm, it's no time to be calling around to find out who is free when your class meets. Exchange home phone numbers so you can reach each other weekends, evenings or early mornings. If you send an email or leave a message asking someone to sub, don't assume everything is arranged until you get a confirmation from that person.

Chapter 9

Tips for the First Day

9.1 Goals for the First Day

Your three goals are closely related — **Be Prepared. Have a Plan. Set the Tone.**

1. *Be Prepared.* First impressions are hard to overcome. You need your students to trust and respect you. Sometimes taking just five minutes before class to organize your materials, so in class you aren't fumbling for the right paper, can have as much positive effect on your students' perception as two hours of lecture preparation.

To be prepared for your first class, follow the “Steps to Take Before the Quarter Begins” (Chapter 8). In particular, be sure you can get to the room on time and have the correct writing implements. Know the lecturer's policies on homework, how course grades are determined and the number of midterms. If he or she passed out a syllabus or any materials the first day, get extra copies for students in your section who missed the first day. Be sure to bring your 1st Day Class List. Review Chapter 19, sections 2, 3, 4, and 5.

2. *Have a Plan.* Your lecturer may give you a plan. If not, devise one yourself. It might include a worksheet, a diagnostic quiz, or an inspirational speech. The goal is for students to realize from the very first day that quiz sections are both important and useful.

By the way, it is often tough to judge how long activities will take, especially if you are new to teaching. Running out of material and having your first quiz section leave early is not a horrible mistake. It is much better to have thirty-five minutes of focussed, useful activity than a full fifty or eighty minutes where the last twenty or thirty minutes seemed unimportant and aimless. Don't let leaving early become a pattern, though.

Along these lines, it is a good idea to have a five to fifteen minute “filler activity”, available whenever you have extra time. This could consist of some mathematical history, your favorite brain teaser, an easily stated open mathematical problem, or even a mathematical joke. Or have some review questions on hand for material from earlier in the course.

3. *Set the Tone.* What are your plans for the quarter? Do you want the students to work closely together? If so, start the first day! Do you want to warn them not to

fall behind? Tell them the first day and set an example by making good use of your time. Are you going to call on students at random (“cold calling”) during the quarter? Start this the first day! Do you want students to present the solutions to problems at the board? Warn them the first day! (It might be asking too much to have them present anything mathematical the first day. You can either devise an activity where they present something short of a polished solution, or you can simply make clear to them that THEY WILL be presenting solutions in the weeks to come.)

At the beginning of the quarter, the students look to you to determine what the course will be like. They will be receptive to a wide variety of activities and class formats. The important thing is to show them what will be expected throughout the course.

9.2 Some Concrete Suggestions

1. At the start of the class, write on the board the course number and section. Tell students who are in the wrong room to check MyUW.
2. You may want each student to fill out an index card listing name and whatever other vital information you might want (e.g. email, tentative major). The supply room in the office has index cards. You can use these cards to help you learn names, to keep notes on how the students are doing, or for randomizing “cold-calling” on students in class. (If you will do the latter, start the first week, and cycle through the whole class every week or so, so no one feels picked on.) You can also use these cards to gather potentially useful information, such as how long it has been since the students took their last math classes.
3. Do some kind of “get acquainted” activity or game. In addition to helping you learn names, this can help your students get over their awkwardness over speaking up in class. For instance, have each person (starting with yourself!) state name, hometown, and favorite food (or hobby, or TV show, or ...). This takes only a few minutes, even in a class of 40. If your class is relatively small, you can try a more elaborate activity, such as having students talk in pairs to learn about each other, then each introduce the other to the rest of the class. Or you can do a “name game” such as “Toss the Ball”. Break the class into groups of six to ten. Give each group a soft ball – wads of socks work well – to toss around the group. Each time the tosser says “Here (name of intended recipient)” and the receiver says “Thanks (name of tosser).”
4. You may wish to use a First Day Worksheet. Typically, such a worksheet reviews skills from previous courses which the students are assumed to possess and which are essential for the course.
5. Encourage student feedback starting the first day: “Am I speaking too quickly?”; “Please let me know if you need me to repeat something I’ve said”; “If I use a mathematical term or symbol you don’t remember, tell me so I can explain it.”
6. If you need filler, and if your class is served by the MSC, draw a map showing where the Communications Building is. Draw a map showing them how to get to your office. If your office is in Padelford Hall, you can include this on the map indicating the Communications Building. A map of the *interior* of Padelford Hall will also help some students navigate their way around this weird building!

9.3 Possible Problems

Annoying but common situations during the first day or week include:

1. Room changes
2. Student turnover
3. Problems with the room
4. Making apologies

In more detail:

1. *Room changes:* As mentioned before, the room assignments are often changed. The most up-to-date information for math classes is available from Math Student Services. The on-line Time Schedule and MyUW usually are correct, but can have a one-day lag in posting changes. Make sure YOU know the right room. Take a campus map with you, to help direct lost students. If your room is changed at the last minute and you have time, write a note on the board of the old room (since boards are sometimes erased, it is even better if you can place a note on the door), or even post a map with the new location circled. If you get to the room early enough to learn of the room change and have e-mail access, then you can notify the whole class using the class e-mail list. Console any upset student who missed your section.
2. *Student turnover:* This is unfortunate but inevitable at a large school. Be prepared to tell students what they missed. Carry extra copies of all handouts from both lecture and quiz section through the second week of classes. (See also Chapter 19, section 2, under “Students adding and dropping your quiz section.”)
3. *Problems with the room:* See Brooke Miller in Math Student Services ASAP if your room is unsatisfactory (e.g. too small or way too big, too far from your other section, only one tiny board). However, you may have to stay in a problem room for the first week or even for the whole quarter. If you’re stuck with a quiz section in a large lecture hall, *insist* from the first day that the students move into the front rows. Tell them to move down to the first five rows, and refuse to continue class until they do (or at least to the first six or seven rows). If the room is very wide, get them to move to the center.

If there are other problems with the room (bad lighting on the board, etc.), confront these during the first couple of classes. Ask the students’ help in determining how to use the space and available lighting options, etc., to make it easiest for them to see and hear you.

4. *Making apologies:* It is OK to apologize briefly to the students for any difficulties you and they have to put up with. But don’t dwell on it, and don’t repeatedly bring up the subject of a recurring problem (such as being stuck in a problem room). No matter how much you might be swearing at the situation internally, lead the class towards a positive attitude and change the focus toward learning.

Chapter 10

Increasing Student Involvement

As mentioned earlier, one of the main goals of quiz section is to get the students actively involved with mathematics. Here are some concrete suggestions:

1. Learn students' names as soon as possible and use their names in class. When you see quizzical looks or other indications of puzzlement, draw the student out by saying something like "Jane, was that last point clear?" or "Is there anything that anybody wants me to repeat or rephrase? John? Amy?" (Note that the form of the questions avoids blaming the student for not understanding.)
2. On the first day of class, have the students write their name plus some other information (major, math background, email) on index cards. You can use these cards to call on students "at random" in class as well as to help you learn names. If everyone is called upon regularly (every other class or so) then "I don't know," or "I'm not sure," becomes a common enough response that it loses its stigma. Even though you probably won't record attendance, this technique gives students the feeling you know and care whether they are in Quiz Section.
3. If the students know each other better, they will be more relaxed and willing to talk. Calling them by name yourself and group work both will help the student get to know each other.

In addition you can facilitate an exchange of phone numbers or e-mail addresses. (Please note: by University policy, you must make clear that participation is voluntary.) Pass around a sheet for students to list their contact information, if they wish to share it; then you can reproduce the sheet and distribute it. Or, ask students to e-mail you, telling you if it's OK to reveal their e-mail addresses to the rest of the class. Then send the whole class the list of addresses you have permission to share. (If a student does not want his or her e-mail address made public, be sure to use "blind carbon copy [bcc]" for that address when writing to the whole class.)

4. Have students read problems aloud from the text: this can help them overcome their shyness in speaking. This also gives you an opportunity to gauge and correct their pronunciation of mathematical symbols.
5. Use the "one-minute essay" technique: at the end of class, give students three to five minutes to write down either one thing they learned or one thing they were confused

about in class. Use their responses as a starting point for discussion during the next class. By clearly reacting to their responses, you create an environment where it is easier for them to speak up. (Yes, the technique is misnamed, but the name has become standard.)

6. If the class discussion is dominated by one or two students (especially if they yell out answers before other students have time to think), then feel free to ask for somebody BESIDES “Tom” or “Susy”. If done appropriately, the student in question will take it as a compliment. In extreme cases, you can (carefully) speak with them in private, outside of class.

Chapter 11

Tips for Time Management

11.1 Outside Class

1. Hold office hours the day before quiz sections or in the morning on the day of afternoon quiz sections. You probably will be amazed by how often this provides you with good ideas for section and saves preparation time. (It is hard to anticipate what the students will have difficulty with. Nothing beats asking the students themselves during office hours.)
2. Work jointly with the other TAs on the homework problems. For example, if ten problems are due, two of you could each do five then share information such as “The first three are straight-forward, but the fourth is tricky, be sure to do the details before class. Here is the key point for number five.” Keep a file of your findings for the next time you teach the course!
3. Coordinate with the other TA on your team:
 - Office hours — aim to avoid overlap, so you cover more hours during the week. Announce both TAs’ office hours to all three or four sections. This should reduce the number of special appointments you need to make.
 - Share the work of making quizzes, worksheets, solution sheets, etc. (And be sure the lecturer gets a copy of everything you hand out in class.)
4. Make sure your students realize that you are also a student taking courses. It is ok to make certain blocks of time off-limits for seeing students, answering student e-mail, etc.

11.2 In Class

1. If it is done poorly, one of the biggest time-eaters is returning papers. Both to learn names and to preserve student confidentiality, it is better if you hand out papers individually instead of just passing the stack around the class. If you have more than one paper per student to return, you can save a significant amount of time by collating their papers before class.

While you are handing the papers back, give the students something constructive to do:

- Return papers while students are in groups during the worksheet session, or write a problem on the board for them to work on while you're passing out papers.
 - If you have an overhead, dimming the lights and putting a problem up on the overhead is particularly effective for focussing their attention.
 - Have everyone write down one question on the day's material and pass them up front for you to see when you're done with the papers.
2. For quiz and test solutions, prepare a handout with the correct answers and comments to pass out or post on-line. Spend class time on at most one or two crucial points. If they have questions, refer them to office hours.
 3. If you are collecting some sort of homework (unlikely because of WebAssign, but possible), be sure to have large, empty folders or big envelopes (available from the supply room) to make it easy to scoop up papers and dump them in your backpack as you head for your next section. Be sure to establish a consistent routine (homework always handed in at the beginning of section, or always handed in five minutes before the end) so that there isn't a lot of student confusion and milling about. If you have to run to different room for your next class, it is usually better to collect homework at the beginning of class, or at least before the end. At the end of class, instead of passing their homework forward, many students will take their time walking to the front of the room with their homework, while others bombard you with questions while you are trying to collect their assignments, and this can all take quite a bit longer than you might expect.

Chapter 12

Homework Grading

The department has recently started giving calculus homework for the 100-level math classes (Math 111-112, 120–126) electronically through a website called WebAssign. In these classes TAs no longer interact with an undergraduate grader. The department is also preparing for some of the more advanced classes (e.g. Math 307, 308) to be graded through WebAssign. Depending on how quickly or slowly this transition goes, when you are an older graduate student teaching one of these classes, you might have a grader or you might use WebAssign.

12.1 WebAssign

WebAssign is an online grading service. Students submit answers to their homework and can immediately see if their answers are correct or incorrect. They are usually allowed five tries on each question to get the right answer before they lose points (though this can be changed by the instructor, for example on multiple choice problems with four options!).

Logging in to WebAssign Go to <http://webassign.net> . Under *Account Log In*, the page asks for your username, institution, and password. Put in *washington* for your institution, and leave the other two slots blank. Click “log in”. On the page that comes up, click “log in” again. Then, enter your UW netid and password as usual.

Using WebAssign Once you have logged in, you should see a page for your class, including a list of homework assignments. (If you don’t see this, then the professor for your class hasn’t registered you in WebAssign’s system yet.) You can click on *View* next to an assignment to look at it. In some problems, some of the numbers in the problem will appear in red. This means that this number is randomized, and different students will see different numbers in its spot.

The most common emails you will get from your students will be complaints that WebAssign refuses to accept their answer even though it’s right. To help your student in this situation, log in to WebAssign and click on *Search* at the top of the page. Select *Student* and type the student’s name. Click on the student’s name in the search results to see the questions, randomized as the student sees them, along with the student’s submitted responses. You can compare the student’s response to the correct answer and find the mistake, which is almost always made by the student. In rare circumstances, the student will be right, and WebAssign will refuse to accept an equivalent form of the correct answer, or

something like that. If the student still has submissions left, just email her back and tell her to put in the answer as WebAssign has it. If she is out of submissions, follow the instructions to add points to the student's score for that assignment (assuming your instructor said it's OK for you to do so).

12.2 Undergraduate Graders

In certain cases (though fewer and fewer), you might be a TA for a class or teach your own class with an assigned undergraduate grader.

Typically, a homework grader is a junior or senior majoring in science or engineering. The extent to which the instructor depends on this grader and communicates with the grader vary, depending on the instructor.

Note that graders start work the second week of the quarter and end work before the end of the quarter. Due to budget constraints, there is only funding available to pay graders for seven weeks of work each quarter. It is certainly appropriate to expect them to meet with you during the first week, but make sure you don't unintentionally try to squeeze an extra week of grading out of them.

Before the Quarter Begins: Talk to the instructor for the course and find out the homework policy. If you are assigned a homework grader, then find out from the instructor how he or she expects the homework to be graded. (E.g., how many problems will be graded? How many points? How leniently or harshly should it be graded?) Also find out whether the instructor will communicate with the grader (for example, about which problems to grade each week), or whether you will be expected to maintain contact with the grader.

First Week of the Quarter: You will drop off and pick up homeworks to and from the grader at the homework boxes. The homework boxes are located in the second copier room (PDL C-136). On the side of these boxes should be a list which gives the name of the homework graders assigned to each class, their e-mail addresses, and the corresponding box numbers where they pick up and leave homework. Note that the box numbers are *below* each mailbox.

It is most often the case that the instructor will meet with the grader to go over what is required and expected of them. Homeworks are generally dropped off for the grader on the day you collect them in class. Contact the instructor to find out if any special circumstances exist with regards to the grader and to find out when you can expect graded homeworks to be ready for pick up.

If you, rather than the instructor, meets with the grader, then tell them the details of how the instructor expects the grading to be done, which day of the week you'll leave homework in the box for them, and which day it should be returned. (Of course, if you are the instructor of the class, you will be in charge of this.) After the meeting you should write an e-mail to all involved confirming everything that was discussed. A summary e-mail or hard copy is a great idea after any meeting with anyone that covers many details.

Recording Scores: It's fine to have the grader keep track of the class's scores, but be sure you have a copy. (You can either have the grader send you the scores each week in an

e-mail attachment, or you can just re-record the scores yourself when you pick up the graded homework.) In the past, graders have lost their records, so you must have a backup.

Problems with the Grader, and Evaluating the Grader: If your grader is not doing their job properly, get in touch with them and let them know. Often the problem is a simple miscommunication. If this does not remedy the situation, let the course lecturer know.

Be sure to tell Danyel Hacker in the Student Services Office if you have serious problems with a grader. Even if it is too late to reassign a grader for that quarter, your evaluation will affect which graders get hired again in the future.

On the other hand, if your grader does a good job, tell Danyel that, too. Also tell your lecturer (who may fill out an official evaluation about the grader at the end of the quarter).

Chapter 13

Tips for Non-Math TAs

By “non-Math TAs” we mean TAs who are graduate students in some other department (often Applied Mathematics). Several special considerations often arise for such TAs.

1. **Scheduling your teaching.**
2. **Communications with the teaching team.**
3. **Math department mailboxes and access to the lounge.**

Information on each of these situations is given below.

1. **Scheduling.** If you discover a conflict between the courses you are assigned to teach and your own courses, we need to resolve this *as soon as possible*. Contact Brooke Miller,

`miller@math.washington.edu`,

in the Math Student Services Office, C-36 PDL, immediately. (Scheduling conflicts are much more likely for you than for Math graduate students, because almost all TA assignments are Tuesdays and Thursdays, and almost all Math graduate courses are Mondays, Wednesdays and Fridays.)

For your second and subsequent quarters teaching in Math, you’ll submit a preference sheet for teaching that will allow you to state your time constraints. If these change after you submit the form, be sure to tell the Math Graduate Program Coordinator immediately.

If you are reassigned to AMath teaching or an RA after an initial assignment to Math teaching, please be sure the Math Student Services Offices knows about the change. Do not assume that someone else will inform us; your new research group, for instance, may say they will take care of it, but mean they will tell the AMath budget office, which may not tell anyone else! If you are switched to an RAship, doublecheck that the GPC in AMath *and* the staff person in AMath (whoever keeps track of teaching assignments) know about your new source of support.

2. **Communications.** Because you spend less time in Padelford than most of the Math graduate students, you need to be especially careful to maintain good communication with the rest of the teaching team. Be sure to check your e-mail regularly (probably several times a day on weekdays). If you have a mail box in the Math lounge, check it several times a week. If you don't have one, arrange with your lecturer some other way to get materials quickly. (For instance, you could pick up materials from the lecturer's own mail box in the lounge whenever told by e-mail that you need to do so.) Consider exchanging home phone numbers, also. *Always reply promptly to messages and instructions from your lecturer or fellow TA, no matter what the medium, so they can be sure you got the information.*

3. **Math department mailboxes and keys to the lounge** You will be assigned a mailbox in the Math department while you are a TA for us. These mailboxes are located in the Math Lounge on the first floor of Padelford Hall. The door to this lounge closes and locks at 5 p.m. weekdays and is supposed to be locked all weekend. To get to your mailbox at these times, you will need a code to the lounge. Ask for it in the main office before the quarter starts.

Part IV

More Tips and Special Topics

Chapter 14

Handling Student Grievances

What do you do when a student approaches you and says “This is not fair!”?

1. Take a deep breath and put the encounter in perspective.
 - (a) Recognize that you are being confronted with an issue of great importance to the student.
 - (b) Recognize that the issue may be almost anything. Students use the phrase “un-fair” as a sort of cry of pain, not as a carefully reasoned out moral judgment.
 - (c) Recognize that many students, especially at the lower division level, tend to see issues as black or white, right or wrong, and have not developed perspective of seeing things as degrees along continua.
 - (d) Recognize that despite the use of the word “fair” the student is probably not attacking you as a person, or even your ethical principles, but is upset about a particular decision or policy.
 - (e) Recognize that you have this student’s undivided attention and are presented with a wonderful teaching opportunity.

2. Listen first.
 - (a) Take the time to hear the student out. (NOTE: This will SAVE you time in the long run. When given time to vent their frustrations, people eventually run out of steam. Interrupting them just stokes their anger further.)
 - (b) Do NOT just invoke a rule.
 - Do NOT say: “No make-ups, read the syllabus.”
 - Do NOT say: “You can drop your lowest quiz. What’s the problem?”
 - (c) Show some (genuine) empathy and concern for the student’s situation.
 - “I also lost important notes once. Is there anything I can do to help fill in the important parts?”
 - “I know the material is difficult. Give it time.”
 - (d) Ask questions to get the full picture.
 - “Have you worked through the study questions at the end of the chapter yet?”

- “Are you getting any help or tutoring to work on your algebra skills?”
 - “Were you surprised by the questions on the test?”
3. Explain your policy — including conditions, if any, under which exceptions may be granted.

(a) If the student has brought up a situation that you have never considered, do not make a snap decision. Explain that you need time to consider the implications of any changes. Set a time to meet with the student in the near future and consult with other TAs or your lecturer.

(b) Explain why you set the policy as you did.

(c) State institutional constraints, but do not go on and on about fine points of administrative policy that are far removed from the student’s concerns.

(d) If you are inclined to grant an exception then do so, but be sure to clarify any conditions (and to check with your instructor first.)

- “I’ll take the paper, Jim, but you must have it here by 5 pm today.”
- “This is the only time I will accept late work from you without penalty, Karen.”
- “Jill, if I let you retake the test you failed, the highest grade I will record will be a C.”

(e) If you are not inclined to grant an exception, explain why.

- “I am not convinced that oversleeping is a good enough reason to set the policy aside.”
- “There would not be time to grade make-up exams for everyone, and I am not comfortable offering this opportunity to just one person.”
- “The lecturer set a policy of no late homework at the start of the quarter, and I don’t have authority to make exceptions.”

(f) It is always acceptable and sometime preferable to postpone making a decision.

- “You make some good points. I’ll have to think about what’s best to do in this situation and get back to you tomorrow.”
- “I have to check with the lecturer. I’ll send you an e-mail.”

This is probably the best approach when asked to regrade a quiz or test problem. (Many instructors have a policy of never changing a score in front of a student, except for obvious addition errors.)

4. Open up a dialogue with the student.

(a) Having shown that you understand their position, try to see if they can understand yours.

- “What do you think would be a fair policy considering all the factors I’ve explained?”
- “What would you do if you were the instructor in such a case?”

- (b) Try to explore a range of options together.
 - “If I allowed you to turn in your homework late, could you have it in by Monday?”
 - “Would you like to try to form a study group with some of the other students in the class?”
 - “If I get the review sheet out earlier for the next exam, would you go over all the material and then come in to my office to discuss any points which are unclear?”
5. When you have reached a resolution, take a few minutes to complete the encounter.
- (a) Validate the student’s concerns.
 - “Thanks for coming by and letting me know how strongly you feel about this.”
 - “If you were always allowed to do extra credit in high school, I can see why this policy surprised you.”
 - “You’ve raised some good points that I will think about.”
 - (b) Affirm a positive relationship and keep the student motivated to learn.
 - “This is only ten percent of your grade, so don’t get discouraged.”
 - “I want you in class because I value your contributions, not just to check off your name in a gradebook.”
 - “Even though I could not grant your request today, I will remember this conversation. If your future course work is strong, I will certainly give you the benefit of the doubt at the end of the course.”
 - (c) Without going overboard, try to get the student to see the complexity of balancing general rules and individual situations.

Department Policy for Concerns About Instruction

(This section is relevant for you, as a graduate student, as well as for the undergraduates in your Quiz Section.)

If you have any concerns about a mathematics course or instructor, the best approach is to contact the instructor about these concerns as soon as possible. We strongly encourage you to make this contact immediately if you are experiencing problems or concerns. If you are concerned about a teaching assistant, you may choose to contact either the TA or the instructor or both. If you are unable to resolve the issue by talking to the TA or the instructor, you may contact Brooke Miller in the Student Services Office, Padelford C-36 (543-6830). If you are still not satisfied with the response you receive, you may contact the department chair, Ron Irving, in Padelford C-138 (543-1151). For your reference, these procedures are posted on the bulletin board next to the Student Services Office, Padelford C-36, and on the Math Department Web site.

Chapter 15

Preventing Cheating on Exams

While it is unpleasant to have to deal with cheating and while it might seem like time wasted compared with “actual” teaching, it is a necessary part of your teaching responsibilities at UW. Some students will attempt to cheat. Even if you ignore it, other students will notice, and they will resent it if instructors don’t seem to care about this issue.

The most common form of cheating in our classes is copying from someone else’s paper during a quiz or test. Other problems include using unauthorized notes/calculators, and changing answers on a graded quiz or test then asking that it be regraded. While the students involved usually are among the weakest in the class, sometimes even “A” students are caught trying to cheat. The following precautions will make cheating less likely and easier to deal with if it does occur.

When administering a quiz or test:

1. Explain the ground rules up front: eyes on papers; keep all papers flat on your desk; no whispering or muttering even to oneself; no books or notes anywhere nearby (floor, adjacent desk) – allowed notes should be on their desks; no sharing of calculators (or calculators away, if they are not permitted); turn cell phones off and put them away. Prevention is always better than confrontation.
2. If there is sufficient room, have the students spread out. Try to leave at least one empty seat between each of them.
3. Tour the room at the start of the test to check compliance with the ground rules.
4. During the test spend some time watching from the front of the room and other times walking around the classroom. Check how the students are doing in regard to time and verify that they are not using any unauthorized materials. Scan frequently to determine that eyes are on papers. In large classes, if it is possible, have more than one instructor present, with one or more at the front and one or more touring the room at all times.
5. In large lecture courses, consider requiring students to furnish picture ID at the time of the exam. One way is to have students present ID as they receive or submit their exams; another is to have them place the ID on their desks where it can be verified during the course of the exam.

6. Pass around a seating chart, for students to sign in. The easiest way to do this is to have a separate sheet for each row, with instructions at the top for the students to write their name in on numbered lines. (Explain the system in class prior to exam day.) This helps send the message that you are keeping track of what goes on during the test, and makes it easy to compare papers if you suspect copying.
7. If you suspect a student is looking at another student's paper, watch the student carefully for a while. Be obvious about this; often a student who is considering copying will look at you to see if you are watching. Thus you can deter as well as detect cheating this way. You also may want to ask the student quietly to move further from other students (if this can be done without too much disruption). If you are not getting a full seating chart, at least record who is sitting next to and in front of the student you suspect may be cheating. After the tests are turned in, compare the papers.

If you are writing a quiz or a test, or setting up the syllabus for a course, you can take some precautions against cheating that also can enhance student attitudes and learning.

1. If possible, allow students to use a "cheat sheet," that is, limited notes, for each test and perhaps for quizzes. Preparing the allowed notes helps students organize their studying and reduces the time they spend on memorization, as well as reducing the incentive to cheat during the test. Be clear and specific in what is allowed, e.g. one side only of a 4 x 6 note card, or both sides of a notebook page. Have an example in class with which to illustrate.
2. Prepare multiple versions of the test. Widely advertise this! Simple variations, such as reordering the problems and changing the numbers used in problems on different versions, are enough to make cheating much less likely and easier to detect. NOTE: Even if there is only one copy of the test, multiple colors can discourage wandering eyes.
3. **Always** take an exam yourself **before** giving it to your students. This allows you to verify the correctness of the items as well as the fairness and reasonableness of the entire test. Students who believe the tests are fair are more likely to play fair, i.e. not cheat, themselves. It will take students approximately four times as long as a typical instructor to complete an exam. Therefore for a 50 minute exam you should complete it in 12 to 15 minutes *at most*. You will learn what your personal "multiplier" is with experience.
4. Lessen the anxiety associated with exams. Some options: Hold a review session a day or two before the day of the exam. Provide sample tests or sample test problems for practice. Weigh the exams such that undue pressure is not associated with any one particular exam.
5. Once grading is finished, it's preferable to choose one of the following options for what to do with the exams. Either all copies of the exam should be kept by the instructor, or if exams are returned to the students then a copy should be made available to future students. The latter can be done in some central location (the library, online on the materials website), or by providing sample tests to later classes.

If you suspect cheating, keep the original of the paper or papers involved, and **notify your lecturer first**. Keep all information confidential. In particular, do not assume email is confidential. If you initiate email correspondence with a student about suspected cheating, say only that you need to talk with the student. For more information on what to do if you suspect cheating, see the your lecturer, the TA Coordinator, or the Lead TA.

NOTE: You never will be required to be the final arbitrator in a dispute over cheating. The University has well established guidelines and a committee for such issues. Your first step (and often your only step) is to inform your lecturer that you suspect cheating and provide him or her with the details.

Chapter 16

Evaluations of Your Teaching

You will get evaluations of your teaching from several sources.

1. In your first quarter in the classroom, your mentor will observe your class and meet with you to discuss what's working well and ways you might improve.
2. At any time during your teaching career at UW, you may consult with the Center for Teaching and Learning about your teaching, including requesting a class observation and/or help in collecting midterm student feedback. (Note: If you initiate contact with CTL, then their interactions with you are confidential; it will be up to you whether to share them with anyone in the Mathematics Department. If the department refers you to CTL, then CTL will send a report to the department.)
3. The lecturer for your course should observe you every quarter; later if you teach a class on your own (that is, if you are the main instructor), you should be observed by a faculty adviser.
4. Every quarter you will be given the opportunity to request (end of quarter) student evaluations in one class. You are *required* to have student evaluations done in at least one class each academic year. Experienced TAs teaching independent sections are required to have student evaluations done in each such section.

These observations and evaluations can be helpful to you and to others. You can use this feedback to improve your teaching, both for the current class and in the long term. Eventually, these evaluations can provide information for a teaching letter of recommendation. For your first two quarters in the classroom, the Dean of the Graduate School requires the department to report on your teaching, and we use the report from your lecturer. (This is done to make sure that someone is supervising the work of new TAs; that is, it's more to check up on the department than it is to check up on the new TAs.) The department uses faculty and student evaluations to identify TAs for teaching awards and for some TA assignments. The department also cares about your student evaluation ratings because they reflect on the department's teaching. You should regard evaluations as a tool for improving your teaching; do not worry that one poor evaluation will determine the department's opinion of you as a teacher or a mathematician. Only a series of very poor evaluations would threaten the renewal of your TAship.

16.1 Observations of Your Class

You can do several things to make an observation of your class by your mentor, CTL consultant, or lecturer more helpful to you. Before the observation, let the observer know what you are trying to accomplish that day in class, and any particular concerns you'd like the observer to monitor. For instance, do you want the students to think more deeply about a new idea from yesterday's lecture, or to practice a new computational skill? Are you concerned about whether your boardwork is effective, or whether the noisy group of students in the back is discussing how to do the problems or the party last weekend? Discuss whether you will introduce the observer to the class. Make an appointment for a day or so after the observation to discuss it with the observer.

During and soon after the observed class, note what you think went well and what didn't, what was typical of your classes and what wasn't. Write these thoughts down before you forget them.

With the observer, reconstruct what happened in class, both what you did and what the students did. Discuss what was effective for helping students learn, and what could be made more effective. Identify teaching practices you want to be sure to continue using, and a small number of specific, concrete changes you want to make.

16.2 Student Evaluations

Every quarter you will be given the opportunity to request student evaluations at the end of the quarter in one class. Remember that you must have student evaluations for at least one class (and for every class you teach independently). You are strongly encouraged to have evaluations done every quarter in all your classes, for feedback for yourself and to create a record of your teaching in your departmental teaching file. The latter is important for decisions about teaching awards, and eventually to provide a basis for future letters of recommendation.

Ordering forms

Midquarter, you'll receive an email from Math Student Services to request evaluation forms. Simply reply to the email by the given deadline to order student evaluations for your section. For a quiz section, be sure you order *and receive* the "Student Evaluation Form: F".

Distributing the forms to students

Pick an appropriate day for the students to fill out the forms; for instance, not right before a test, when they'll begrudge taking class time away from review, and not the same day that you return a test with low scores. **Do the evaluations early in the class period;** if it's done near the end of class, many of them will just leave, either before filling out an evaluation, or after without waiting for anything else you planned to do.

You should explain some points about the forms to your students, to insure accuracy in the results. Be sure they understand that "5" indicates best and "1", worst. Answers to questions such as "Is this course in your major, a distribution requirement, ... ?" affect

adjustments that are made to the medians for student responses. These adjusted medians are important not only to you but also to the department, because they are used by the department and the administration to judge the department's teaching performance. Please make the following points clear to your students.

- They are evaluating you and the quiz section, not the lecturer and the lecture classes. (The lecturer may or may not do evaluations in lecture.)
- Their answer to question 28, hours per week spent on the course, should include time in class, and concerns the entire course (lecture and quiz section combined).
- For question 31, "in your major" means math majors. If they are taking the course because it is required for their major in engineering, biology, etc., they should describe it as "a program requirement."

On the cover sheet that *you* fill out, one question needs clarification. You are asked if you want a copy of the results (numerical ones only, not the yellow comment sheets) sent to the chair of the department. Your answer only determines if a complete hard copy is sent. The chair always receives an electronic copy of the adjusted and unadjusted medians for all questions. **Please answer "yes" to the question "Chair copy?"** so that the department receives a hard copy of your evaluation. Hard copies are useful to Math Student Services, the Graduate Program Coordinator, and the TA Coordinator, among other reasons for planning changes in courses and TA Training and for making TA assignments.

Getting the results

The report on the distributions of numerical responses, plus the yellow comment sheets, will come back to you near the beginning of the next quarter. The Office of Educational Assessment (OEA) has a webpage on this "Instructional Assessment System" at

<http://www.washington.edu/oea>

Under "Course Evaluations", "UW-Seattle Users" there is lots of information about interpreting your report. In particular, they have a database of "IAS Norms" which allows you to compare your median ratings against courses in similar disciplines.

Typical (unadjusted) median ratings for beginning calculus TAs for the first four questions are in the range 3.0 (good) to 4.0 (very good) for question 3, and a bit lower for questions 1, 2, and 4. Don't be discouraged if you fall in the low end of this range even though you were sure they'd say you were excellent (5.0). Several factors tend to depress these ratings compared with ratings you will get later and ratings in other disciplines. The experience you've gained this quarter will make it easier for you to avoid mistakes you've made and to help your students learn in future quarters. Also it will be easier just because you won't be adjusting to a whole new life! Remember that many if not most of your students were fresh from high school, and so were adjusting to college. The role of a teacher in college is different than in high school. Students have more responsibility and must do more work. Freshmen may fail to recognize this fully, and think that their first quarter instructors are not doing their jobs — this can contribute to lower student ratings. Finally, OEA studies have shown that class size, expected grades, and the reasons students take courses are correlated to ratings, and for our calculus classes all these factors tend to lower ratings. The adjusted medians do take these factors into account.

Nonetheless, low ratings do mean that the students did not perceive your classes to be as productive as they should be. How do you turn this generalized indication of discontent into information you can use? Use the ratings on the more specific questions 5-22 and the written comments on the yellow sheets. Also consider comments from those who observed your class – your mentor, CTL consultant, and/or lecturer. You will notice a variety of opinion: no matter what you do, it will fail to connect with some students. (Some teachers make a game of matching diametrically opposed comments from different students.) But if several people are unhappy with some aspect of your teaching, even if some students liked it, think about ways you could vary what you do to be effective with all types of students.

- Did you have great interaction with 10 or 15 students, while the others were sitting there quietly lost? Try to encourage students to tell you their difficulties early in the quarter, instead of waiting for the evaluation forms.
- Were a number of students unhappy with your explanations? Be sure you present material in a variety of ways: pictures and formulas, for instance, while making sure you write down anything important that you say in class.
- Despite your many office hours, did they complain that they couldn't get help? Remind students about your hours frequently, perhaps every week or even every class.

Sometimes what you want to change is student attitude. This is not just a matter of improving your ratings: students who are happy with the way the class is run will participate more effectively, and probably will learn more. Comments on the evaluations may indicate that students don't like certain aspects of the course that you cannot or choose not to change. But you can try to make it clearer to students why the course or book or class period is set up in a certain way, and what they are supposed to get out of it. Also, give the students positive reinforcement about their work: when they solve a tough problem in class, on homework, or on a quiz or test, tell them they did a good job. Praise good ideas suggested in class (even when they are only one step of many to be taken), and help students gain perspective on what they have learned.

Some student complaints have meaning even though what they seem to say is clearly false. For example, students have sometimes complained that I know “too much” math, so that I cannot relate to their difficulties with the course. This only happens in courses where I just barely know more than what the students are supposed to learn! It took me a while to realize that when I am still struggling with organizing the material myself, I can't focus enough on the difficulties of the students, leading to the complaint that I'm too far ahead of them. Similarly, students are likely to interpret any communication problem with an International TA (ITA) as a problem with the ITA's English. In fact, if students believe that the ITA has their interests at heart and is presenting useful information, they will forgive many errors in grammar, word choice, and pronunciation. But if for instance the ITA gives abstract general information when the students want a concrete example, they are likely to say the ITA can't speak or understand English, even if the English is actually flawless and barely accented.

Midquarter evaluations

Research by OEA suggests that one of the best ways to improve your student evaluations is to do some kind of midquarter evaluation, then respond to student suggestions or com-

plaints. Such midquarter evaluations can be as informal as asking the students to take out a piece of paper and write down one aspect of class that is helping them learn and one aspect that isn't. Or you can make an online survey on Catalyst (<http://catalyst.uw.edu>) that asks those questions, or more specific questions that concern you, such as "are my explanations usually too advanced / just right / oversimplified for you?" or "is my writing on the board clear?" or "do I talk too fast?" After querying the students in perhaps week five of the quarter, pick one or two points to respond to, and do some combination of making changes and better explaining of current policies. If you are a new TA, your mentor can help you with this.

CTL offers a more substantial midquarter evaluation in the form of a class interview called a small group instructional diagnosis (SGID). A CTL consultant talks with the students for 25-30 minutes and summarizes the discussion for you. The results tend to be more constructive than comments on the evaluations at the end of the quarter.

If you are teaching a quiz section, be sure to ask the lecturer before you take class time for a midquarter evaluation. As with the Student Evaluation of Teaching forms, it is better to have the students fill these out at the beginning of a class period rather than at the end so that they don't just leave instead.

16.3 Evaluations by Faculty

Ideally, you should be observed by your lecturer or another faculty member every quarter that you teach, for a variety of reasons. Observations of quiz sections should promote communication between lecturers and TAs, both about how the specific course is going and about teaching in general. I find visiting quiz section is sometimes an important "reality check" about how the students are handling the material. Also watching someone else teach gives me ideas for my own teaching. The written reports from faculty about TAs are kept on file to consult when we decide on teaching awards or when we are looking for a TA with particular skills for certain TA assignments. Finally, the reports supply specific information that can be used by someone writing a teaching letter of recommendation for you at some future date. (Also, for your first two quarters, we're required to forward copies of the reports to the Dean of the Grad School, but that's not the reason we started asking faculty to do these reports.)

In practice, after your first two quarters in the classroom faculty may skip observing your teaching, or, having observed, may fail to write a report. **Experienced TAs should make sure they are observed and evaluated by faculty on a regular basis.** If you haven't been observed recently, or even if you have, you may want to *ask* for a faculty observation and report, especially if you are teaching your own evening, summer, or 300 level course. You want your departmental teaching file to reflect your teaching performance, both for possible consideration for teaching awards and for that teaching letter of recommendation that most of you will need someday. Ideally, you'll be able to ask someone who has actually observed you in the classroom, preferably more than once, and they also will look at the written reports of other faculty you've worked with and student evaluation information you supply. You need to make sure there are some such reports and student evaluations! You may even want to pick out a faculty member you aren't working with, but would like to have write you a letter, and ask him or her to visit your classes periodically. This is especially true if you are teaching your own class (evening, summer, 307, etc.), because if you don't

ask, probably no one will observe you. Then when you need that letter, you may discover that you are in a non-classroom assignment (MSC, grading, RA, computer jobs, even Lead TA) and no faculty member has seen you teach for years!

Chapter 17

About Your Students

Your high school math education and college experience may have been very different from that of UW students, especially if you are an ITA. This chapter gives some background information on the students who will be in your class. The first section is particularly valuable for ITAs, since it gives an overview of the American school system prior to college. All TAs should read the subsequent sections.

17.1 The US School System

The pre-college school system is divided into elementary (kindergarten and grades 1 through 5 or 6), middle school or junior high (grades 6 or 7 through 8 or 9), and high school (through grade 12). For simplicity, in this chapter we will include grades 9 through 12 when we say “high school.” With very few exceptions, high schools are not specialized: students planning to attend college and those not intending to attend college attend the same schools and even take many of the same classes.

Most students apply for college in their senior year of high school. They must take a standardized college entrance exam, most likely the Scholastic Aptitude Test (SAT). (In other parts of the country, another test, the ACT, is more widely used.) This test score and grades in high school are two of the factors the University of Washington and other colleges use to determine admittance. Once in college, the undergraduate degree program is nominally four years, but many students take five years to complete it. Students do not have to decide on a major field of study until they have been in college for a year or two, and changing majors is common.

Alternatively, many students attend community college between completing high school and attending the UW. Community colleges offer two-year academic degrees and also programs of technical training aimed at particular careers. Students may earn an Associates Degree in two years and then transfer to the UW to finish their degree. About 40-50% of each UW graduating class are transfer students. However, you will not see that many transfer students in your calculus classes, because most likely such students will have taken the calculus series at the community college.

In both high school and college, the terms freshman, sophomore, junior, and senior are used to indicate those in the first, second, third, and fourth years, respectively, of school. (Three year high schools use the terms freshman, junior, and senior.)

17.2 Profile of the Typical UW Calculus Student

Most of your students will be freshmen, some will be upperclassmen (including transfer students), and a few may be students returning to college after working or raising a family. In fall quarter, even in 125/6, almost all these students will be taking their first UW math course. About 44% of entering freshmen were in the top 10% of their high school graduating class.

By the end of high school, a typical student has taken two years of algebra, a course in trigonometry, a geometry course, and perhaps a pre-calculus class. While many schools still separate their math classes into these separate topics, some have an “integrated” curriculum that combines algebra, geometry, even some probability and statistics into a multi-year sequence often called “Integrated I, II, and III.” The pre-calculus course may be labelled “math analysis” – not to be confused with our 400 and 500-level courses with similar names! – or “math anal,” or just “functions.” Some students will also have taken a course in calculus, or their precalculus course may have included an introduction to calculus.

Some of your students may not have taken math for a year or more. UW entrance requires only three years of math. (It also requires only two years of science, one of which may be general science. In particular this means your students quite likely have not taken physics.) Even some students who are good in math may not have taken math as senior in high school, because they had taken the most advanced math course in their school as juniors. Upper classmen and returning students may not have taken math since high school (which can be many years ago).

Surveys of prospective students indicate that almost a third plan to live off campus, and that most expect to work while attending college (median expected hours per week between 10 and 15). In a survey some years ago, students reported spending an average of six hours per week on homework for *all* their high school classes.

Many of our calculus students are intending to major in engineering (which includes computer science), chemistry or biochemistry, other sciences, or business. At UW, students must apply to a department or school to be admitted as a major, and admission to many of these majors is competitive. This creates an additional pressure to get high grades.

17.3 Implications for Teaching

As most of your students in the fall quarter will be freshmen, the structure of college classes is new to them. The format of lecture and quiz section is much different than their high school math class. In high school they were in small classes and had one teacher who they met with frequently. If they had questions, their teacher most likely answered them in class. They may have completed all their homework in class, and done little if any additional study. Now they have large lectures, quiz section, and a new concept of office hours.

In its *Note to Math 124* (respectively, *125*) *Students*

(<http://www.math.washington.edu/~m124/math124studentnote.php> and
<http://www.math.washington.edu/~m125/math125studentnote.php>)

the Department of Mathematics tells students that to succeed in the course they should spend

15 hours OUTSIDE of class working on homework, reading the text, reviewing lectures, etc. Similar advice applies to Math 120 and 126. This is in line with the University Handbook guidelines. Students are also encouraged to spread their study time evenly across the week and the quarter. In contrast, students rarely study this much in high school. Often a student could succeed in high school by cramming for a test. This study technique rarely works as well for them in college, because the pace of college courses is much quicker and the material is explored in more depth than in high school. (As an example, one student remarked to me that “my high school teacher spent a week on related rates, you covered it in one lecture.”)

Several factors can distract students from spending the time they should on study. They are adjusting to a new life-style. College offers an abundance of new activities. They may be working part-time, or even close to full-time. They are used to getting high grades with much less effort than college courses require. Finally, some students may have seen some of the material before. For example, a student may have taken some calculus in high school, and is now taking 124. They assume that they already understand the material, when in fact they may have forgotten it (or never learned some of it in the first place). **It’s important for a TA to remind students throughout the quarter of what it takes to succeed.**

Most students will have forgotten some of the prerequisite mathematics over the summer, or in some cases in the year or more since their previous math course. **Be prepared to review prerequisite material.** This may mean a quick review during class of some formula or concept, or a longer discussion during office hours. You should try to **make clear that although it is common for students to need some review, they must bring their skills up to speed quickly** to do well in the course.

17.4 Placement in UW Math Classes

In order to register for a math class at the UW, the student must have the proper prerequisites. For a student new to the UW (with no prior college math class), these prerequisites are measured with a variety of placement tests. As a TA you are not responsible for knowing all the different prerequisites for courses, nor are you responsible for advising a student about his/her courses. For this you should direct the student to the Math Student Services. However, a student may mention these tests, so the basic information is listed below.

At the end of high school, many students take Advanced Placement (AP) tests. There are two AP tests for calculus: Calculus AB and Calculus BC. A student will have taken one or the other. Often high schools offer classes called “AP Calculus.” These classes teach calculus and prepare students for the AP exam at the end of the school year. The tests are graded on a scale of 1 to 5.

- A student may take Math 124 if he/she has an AP score of 2 or higher on the AB or BC exam.
- A student may take Math 125 if he/she has an AP score of 3 or higher on the AB exam or 2 or higher on the BC exam.
- A student may take Math 126 if he/she has an AP score of 5 on the AB exam or a 4 or 5 on the BC exam.

Alternatively, if the student has not taken any AP exams, they must take a placement test offered by the UW. There are two different exams: “Intermediate Math Placement” and “Advanced Math Placement.” These two tests will place students into Math 111, 120 or 124.

Once a student has taken a college math class, they must receive a minimum grade to advance to the next class in the series. For example, to advance to 124, a student must have a 2.5 in 120, and to advance to 125 or 126, they must have a 2.0 in 124 or 125, respectively. Students may also need minimum grades for admission to specific majors.

17.5 Freshmen Interest Groups

If you TA 124 in the fall quarter, then you may have a freshmen interest group (known as a FIG). It is usually easy to tell from the first day. Most incoming freshmen don’t know anyone in the class, so there will be very few conversations and a bit of nervousness in the classroom. In a FIG section everyone will seem to know each other already. This is because they do.

A FIG is a group for incoming students with a common interest such as economics, computer science, biology, etc. They have been meeting regularly for some time before the start of the quarter to get to know each other. It is good to be aware of FIGs, because it means almost everyone in your class has a common interest. You can check online at <http://fyp.washington.edu/figs/search/> to verify if your section has a FIG.

Once you know you have a FIG, you can tailor examples and applications to their interest. You should be a little careful to not only give applications in the FIG’s interest, since there are probably a few students not in the FIG already.

Potential problems with teaching a FIG is that they are sometimes harder to control, since some students already know they have the support of most of the class behind them if they challenge you on something. It also might be hard to integrate the students not in the FIG into group work. For the most part teaching a FIG should be a good experience, since they tend to be a lot more motivated and advanced.

Part V

Departmental Information

Chapter 18

Mathematics Department Information for TAs, 2013-2014

The Main Office

C-138

Ron Irving, Chair of the Math Department	543-1151, chair@math.washington.edu
Mike Munz, Department Administrator	543-6163, munz@math.washington.edu
Rose Choi, Secretary to the Chair	543-1151, rosechoi@math.washington.edu
Susan Malti, Fiscal Specialist (1-5pm)	543-1152, malti@math.washington.edu
Chris Bonneu, Office Assistant	543-1150, chrisb49@math.washington.edu

The Graduate Program

John Palmieri, Graduate Program Coordinator [GPC]	C-538, 543-1785 mathgpc@math.washington.edu
David Sprehn, Graduate Student Representative [GSR]	C-111, gsr@math.washington.edu

Undergraduate Teaching

Alexandra Nichifor, Math TA Coordinator [TAC]	C-326, 543-7898 nichifor@math.washington.edu
Christian Rudnick, Math Lead TA	C-113, rudnickc@math.washington.edu
Matthew Conroy, Math Study Center [MSC] Director	B-014 CMU, 685-4703 conroy@math.washington.edu
Math Study Center (MSC):	B-014 CMU, 685-4714
Math Student Services Office (Math Advising)	C-36, 543-6830

Mathematics Research Library

C-306, 543-7296

Faye Christenberry, Head Math Librarian

mathlib@u.washington.edu

Departmental Computing

616-3636, help@math.washington.edu

Kevin Loranger, Software Engineer

C-30

Steve Sheetz, Senior Computing Specialist

C-32

Office Hours

The Departmental Office (C-138) is open from 8:00 AM until noon and from 1:00 PM until 5:00 PM, Monday through Friday. The office is locked from noon until 1:00 PM.

Keys

Keys to your office and the building may be obtained from C-138. After passing prelims, students may also obtain Math Library keys from the Math Research Library.

Photocopying Class Materials

Copying Class Materials: You will be responsible for copying your own teaching materials. Copy codes for teaching materials will change quarterly, and must be obtained from the lecturer for the class. The department asks everyone to limit class materials copying to 40 pages per student (per quarter).

Copying Research Materials: Every graduate student will have a copy code to be used for research purposes. The office staff will send yours to you via e-mail. There is a limit of 1000 copies per year. You will not be charged for these, but do restrict use of this code to research only.

Laser printing

Laser printers are located in C-340 and outside C-552.

Teaching Supplies

There are supplies located in the work-room of C-138. These are ONLY to be used for the classes YOU TEACH, not for personal supplies. Some supplies are in locked cabinets; ask the office staff for assistance.

Faxing

The department's fax number is 206-543-0397. You may receive documents through our fax, as long as it's low-volume. We do local personal faxing, but not long-distance personal faxing. Long-distance faxing is for university business only. Only office staff may use the fax machine. Long-distance personal faxing can be sent from the HUB Information Desk or the fax center in the Communications Building, B-045 CMU.

Leaving Messages

Since phones and voice mail are not provided in student offices, feel free to use the main line (206) 543-1150 as your work phone number for non-student contacts. Whoever answers the phone will take a message and send e-mail to you (students should use e-mail to contact you!)

Telephone System

To place on-campus phone calls, dial the last five digits of the number only (3-xxxx or 5-xxxx or 6-xxxx). For off campus calls, dial 9 and wait for a dial tone, then dial the number including area code. For campus and local outgoing calls, there are phones in the lounge kitchen and, for safety reasons, in the "dungeon" (the C-8 offices). The number for the latter is 545-7145.

Lounge

The Faculty and Student Lounge is located in C-120. There is a small kitchen where coffee, a microwave oven and a refrigerator are available for your use. Tea is served on weekdays when classes are in session at 3:30 PM. The lounge is open Monday through Friday from 8:00 AM to 5:00 PM. At other times a code is needed to enter the lounge. Please see the main office (C-138) for the code.

Mail

Mailboxes are in the entryway to the lounge (C-120). Math graduate students have been assigned a mailbox, shared with another student, alphabetically starting to the right of the window. The non-Math TAs have shared boxes in a second alphabetical list after the Math grad students. All outgoing mail, including both campus and stamped mail, can be put in the white bins located in C-120 or C-138. Please do not use the department's mailing address for personal mail. Delivered packages and oversized mail are put in the supply room in C-138. You will be notified by e-mail if this occurs. The department does not pay shipping for letters or packages unless special arrangements are made.

Payroll

Paydays are the 10th and 25th (or the nearest workday to these dates) of each month. Checks can be picked up in C-138 after 11:30 AM. Through MyUW, under Employee Self-Service (ESS), you can arrange for your check to be directly deposited into your bank account, and view records of your wages, taxes withheld, etc.

Library

Your Husky card serves as your library card. It has a magnetic stripe on the back which will be activated when you register. If you wish to use your library card before the Registrar's Office has downloaded the magstripe information, you may activate your account at any UW library. You will need to set up your UW Net ID and password in order to access your library account online. Instructions on how to do that can be found at:

<https://weblogin.washington.edu/> .

Click on "Need a UW NetID?". Library overdue, hold and recall notices will be sent to your registered email address. Once registered, you may access your library account by typing in your UW Net ID and password at the same web site. There you may renew books, place holds on checked out materials, and order books from other library units. You'll need your UW Net ID to borrow items via the Summit Catalog from other universities and colleges in Washington and Oregon.

You are responsible for:

- The use of your card. Do not loan it to others.
- All material checked out on your card. Do not loan material to other borrowers.
- Knowing due dates. Dates may change based on renewal and recall requests.
- Returning or renewing materials on time.
- Library notices sent when you are out of town.

Report lost or stolen cards to the Libraries immediately. Fines and billing charges are assessed to encourage prompt return of materials. Fines apply all days and all hours, even if the library is closed. Fine notices are mailed to your home address.

From the Math Department home page you can reach the Math Research Library's home page

<http://www.lib.washington.edu/math/> .

The Off-Campus Access link at the top right allows UW users to access library databases and journals remotely after supplying your UWNetID and pin.

Reserve books for higher-level Math courses (400 and up, some courses in the 330-399 range) are found in the Math Research Library, C-306 PDL. Reserve books for lower level courses are found in Odegaard Undergraduate Library. Some other libraries often of interest

to mathematicians include the Suzzallo (graduate research) and Allen (natural science) Libraries (in one building), the Engineering Library, and the Physics-Astronomy library (C620 Physics-Astronomy Building).

The Math Research Library staff invite you to visit the library (C-306 PDL) anytime to meet them and get a quick introduction to the library. They're also available for help with in-depth library research. Once classes begin, the library is open M-Th 9:00 AM -6:00 PM, F 9:00 AM - 5:00 PM, and Su 1:00 PM - 5:00 PM.

Chapter 19

Math Advising, Adding Classes, Course Requirements and the Like ...

“But I have to get into your quiz section!”

— chant shouted in unison by six students after your first section

First and foremost — as a TA, you are neither required nor expected to be an expert on the manifold possibilities of courses an undergraduate might take or the bureaucratic intricacies of adding and dropping courses. When you are confronted with a question whose answer you don't know, or if you are asked any question of deep importance concerning a student's major, please refer them to the Math Student Services office mentioned below.

HOWEVER, the following pages give you the answers to some basic questions. Some will be useful for your own purposes and some will save you from looking ignorant in front of your students the first week of your first quarter of teaching.

- TAs should read this entire chapter.
- If you are a new Math student and not a TA, read sections 19.1, 19.2 (except the last part, about quiz sections), 19.3, and 19.5.
- International students, be especially sure to read section 19.6.

19.1 Resources

The answers to many questions like the ones in this chapter are in the UW Student Guide, available on-line at

<http://www.washington.edu/students/> .

Feel free to look there or refer students there for any basic questions whose answer you don't know. More complex questions should be referred to the Math Student Services Office. Be aware that the office is extremely busy the first few weeks of the quarter.

Math Student Services is in PDL C-36 (543-6830):

Brooke Miller, Director of Math Student Services advising and scheduling	miller@math.washington.edu
Danyel Hacker, undergraduate advising	danyel@math.washington.edu
Katharine Swigart-Harris, undergraduate advising	kash@math.washington.edu
Randy Katz, office assistant	ktzr2@math.washington.edu

You should refer students to Math Student Services when they ask if they should switch to a different course. TAs are not responsible for knowing what prerequisites are or which courses satisfy which requirements. Some information on the entry-level mathematics courses is included in this manual, so that you may at least know what courses are available. If you do tell students about the various courses, be sure they understand that they should check on the details with Math Student Services.

Finally, Math Student Services is also a very useful place for YOU. It issues the text-book(s) for the course you are teaching and handles room scheduling. See Brooke if there are any problems with your classroom or if you need a room for a review session. If you are taking a reading course with a math professor, then you must get the entry code from Math Student Services.

19.2 Registration

At UW, students (both grad and undergrad) register for classes and make changes in their schedules using MyUW, www.myuw.washington.edu. You must have a UWNNetID – that is, a computer account with an “@u” address – before you are allowed into MyUW. Once you have the account, you can access MyUW with any web browser. You can find out about UW accounts at

<http://www.washington.edu/computing/uwnetid/> .

You can find tips for registration in the on-line Student Guide

<http://www.washington.edu/students/>

by following the links “Academics → Registration Tips.”

In registering for your own courses, note the following:

1. You should register for GRDSCH 615C this quarter. Doing so will give you one credit (pass/fail) for attending the math department TA training. This course is listed under Graduate School (Interdisciplinary Graduate Programs) in the University of Washington Time Schedule.
2. All students are required to provide proof of *measles immunity*. You will not be able to register for classes until this requirement has been satisfied. Please follow the links

“Student Life → Health Care → Immunization Requirements” in the on-line Student Guide to see details about how to fulfill this requirement.

3. *PLEASE NOTE, VERY IMPORTANT!* You must register for at least one course (ANYthing) before classes begin, or you'll be charged a late registration fee. You can fine-tune your schedule the first week of classes after attending classes for a day or two, talking with your advisor, etc.
4. It's best to take care of registration changes before 4 PM on the fifth day of classes, in case information is needed from Student Services (e.g. an SLN [line number] for a recently added course, or an entry code for a reading course). To add a class during the next two weeks of classes, you need both permission of the instructor and an entry code from Student Services (and you will be charged \$20).
5. If you are an RA or TA, you will receive health insurance as part of your compensation. **See more information at**

www.washington.edu/admin/hr/benefits/insure/gaip/deadlines

Before you register for classes on MyUW, the system will ask whether you want student insurance. If you are a US resident (and an RA or TA), answer “No” to the question of whether you want student insurance. Student insurance is unnecessary since you already receive RA/TA insurance. HOWEVER, if you are an international student (ITA), the system may require you to answer “Yes” to this question. You will receive information about student insurance refunds when you get your RA/TA insurance information package.

Go to Math Student Services for entry codes, or if you have any questions about your own courses. (Of course if you are a grad student in another department, substitute advising in your department for Student Services in the advice of this subsection.)

Changes in registration

Changes (both adding and dropping courses) can be made for free through the seventh calendar day of the quarter. Between the eighth and twenty-first calendar days, a student needs an “entry code” to add a class; also, there is a \$20 fee which covers all scheduling changes made in a single day. (Multiple changes made on a single day incur only one \$20 fee, but if you drop a single class Tuesday and then add a class Wednesday, your fee will be \$40.)

Students adding and dropping your quiz section

For students trying to get into your quiz sections, the best advice to give them is to keep checking MyUW. Most sections will already be full, but lots of people move in and out of classes (especially 120 and 124) throughout the first week. In most cases a student who keeps trying, even through the weekend, will get in before the \$20 fee goes into effect.

They may tell you that they want to “overload” (get into a class that is full), and ask you for an “entry code.” They also will ask for an entry code if they are trying to add the course

the second week of classes. Quiz section TAs are not responsible for making decisions about these situations; refer students to the lecturer or the Math Student Services Office. The lecturer should set the policy on entry codes; the Math Student Services Office gives out the entry codes (with the permission of the lecturer) and handles questions about prerequisites, etc. The only thing the TA *might* need to do is keep a record of those students who are trying to add the course and who actually attend quiz section; the lecturer may want this information for deciding who should get overloads.

For courses dropped through the fourteenth calendar day of the quarter, no record of the drop is kept. In addition, students are given one “Annual Drop” per academic year. This allows the student to drop a course until the end of the seventh week of the quarter. The course will appear on the student’s transcript with a grade of “Wx” where x is a number between 3 and 7, signifying the week during which the course was dropped. If there are extenuating circumstances, the student may petition for a “Hardship Withdrawal” if they don’t have or don’t want to use their Annual Drop. (Hardship Withdrawals are difficult to obtain.)

19.3 Grading Scale

UW uses a numerical grading scale. Some freshmen will be uncomfortable with this; if necessary, you can provide them with the following conversions.

A	4.0 – 3.9	C+	2.4 – 2.2
A–	3.8 – 3.5	C	2.1 – 1.9
B+	3.4 – 3.2	C–	1.8 – 1.5
B	3.1 – 2.9	D+	1.4 – 1.2
B–	2.8 – 2.5	D–	0.8 – 0.7

For undergraduates, 0.7 is the lowest passing grade. A grade of 0.0 signifies either failure or an unofficial withdrawal. For graduate students, grades below 1.7 are recorded as 0.0, and a minimum grade of 2.7 is required in each course counted toward a graduate degree.

19.4 Grade Requirements for Majors and Course Prerequisites

This section concerns the meaning of grades for the undergraduates in your quiz section. Many majors require not only particular courses, but have minimum grades required. For example, engineering majors need at least a 2.0 in Math 124. If a student does not make this grade, they have the option of taking the course again. The first and second grades count for computing the GPA, but only the highest grade is considered toward the major’s requirement.

Note: To enter Math 124, a student must get at least a 2.5 in Math 120. All other Math courses with prerequisites require at least a 2.0 in the prerequisite course. For example, to continue from 124 to 125 or 125 to 126, a student must get at least a 2.0.

IMPORTANT: The registration system will allow the student to register for a later course if they are currently enrolled in the prerequisite, but they will get bumped once a final grade below the cutoff has been entered into the system.

19.5 Social Security Numbers

If you are a TA or an RA and do not have a Social Security Number (SSN), apply for one as soon as possible. Students who do not have the same SSN in both the payroll system and Student Data Base system may find that Graduate Appointee Insurance, tuition waivers, insurance waivers, etc., will not be in force. The systems must have a common SSN to locate a student in both systems.

To correct (or enter a newly acquired) SSN in the Student Data Base system, students should go to the registrar's office in Schmitz Hall with their Social Security card.

To correct (or enter a newly acquired) SSN in the payroll system, please see Mike Munz in the department office (C-138).

If you are an **International Student and a TA (or RA)** – that is, an ITA – you may obtain a valid SSN by doing the following steps in order.

1. Register for at least 10 credits (on MyUW). You may easily change these courses through the first week of classes. (See section 19.2 above.) But an ITA must be registered as a full-time student (for graduate students, a minimum of 10 credits) to get a SSN.
2. Go to the Social Security Number page of the ISS website here:

<http://iss.washington.edu/employment/ssn#toc1>

Print out the Verification form and complete it with your hiring official/supervisor and submit the form to the ISS front desk in 459 Schmitz Hall. It will be signed by an ISS advisor and you will get an email when it is ready to pick up.

3. Take this letter, your I-20 or DS-2019, I-94 card, and passport to the Social Security Office in downtown Seattle and apply for a SSN.

It will take two or three weeks for your SSN to be issued. In the meanwhile, the University payroll system will assign you a temporary number. See Mike Munz in the department office (C-138) if you have questions about this temporary number.

4. When you get your SSN number, be sure to enter it in both the Student Data Base and payroll systems. (See instructions above for doing this.)

Chapter 20

The Math Department Computers

The first, and most important, information to know is how to get answers to your questions. Sending mail to help@math.washington.edu is the best way to get questions answered and problems solved.

You will have a PC in your office. There are also computers available for your use in Padelford C-340.

A few details: For the combination to the computer room, C-340, ask in the Main Math Office, C-138. There are printers in C-340, and in the locked cabinet outside C-552; if you will be using the latter, get the cabinet key from C-138.

The computing staff offices are on the LL floor, just down the hall from the Math Student Services Office, C-36. See Chapter 18 for a list of staff names, or see:

http://www.math.washington.edu/People/staff_list.php.

20.1 Finding Basic Information

Online, there is a Math Wiki that has a collection of information. You can find this Wiki at

<https://depts.washington.edu/helpmath/mediawiki/index.php?title=Help> .

You'll need to log in using your UWNetID and password. A good starting point in the Wiki is the Orientation page at

<http://depts.washington.edu/helpmath/moinmoin/moin.cgi/Orientation>

20.2 Getting Started

20.2.1 Getting Started on the PCs

Most grad-student offices are equipped with PCs. To **login** to the PC, press “ctrl+alt+del”. (You may have to move the mouse around or strike the spacebar to “wake up” the monitor.) You will be prompted for your user name and password. This is the user name (and email

name) that you were given by the main office when you were assigned an account. If you have not yet changed your password, your password is whatever you were given by the main office when you received your account information. The same password is used for Windows, Unix servers, and your @math e-mail.

If you are working on a PC, you still have the capability of running applications residing on Unix-based servers. (This is especially useful if you want to use Emacs and compile with L^AT_EX.) To do so, you will need to an XTerm window and the program **X-Win32**. First, start up the **X-Win32** program. (Look for it in the Start menu.) X-Win32 needs a small amount of configuring the first time it is run. Then use the **SSH Secure Shell Client** program to log on to Zeno. Click on the “File” menu, then “Quick Connect”. You will be prompted for the host name, “zeno” and your user name (the same user name as above). Enter these and click “Connect”. You then will be prompted for your password. Once you do this you will now have an XTerm window. From this XTerm window, you can perform any of the commands listed above in the previous subsection.

There are two ways to logout of the computer. Either press “ctrl+alt+del” and then choose “Log Off”. Or from the Start Menu, choose “Shut Down”, and then choose the command “log off username”. *Remember to log off every time you are done using the computer in order to keep your account safe.*

20.3 Changing Your Math Department Password

The first thing you should do when you login to the department server for the first time is to change your password. You were given a temporary password by the main office so that you can get started, but you should change your password immediately to something that only you will know.

You can change your password in one of two ways:

Start an SSH session on Zeno, and type ”kinit”. You will be asked to enter your old password (the one you want to change). Then type ”kpasswd” (all lower-case letters) and press the Enter key. You will first be asked to enter your old password (the one you want to change), then you will be asked to enter a new password. Your new password should be at least 6 characters long and should contain both upper- and lower-case characters, or should contain both letters and non-letters. If the password you try to use does not meet these criteria, you will be told so and asked for another. Just type the password you want to use and press the Enter key. Once you have entered an acceptable password, you will be asked to enter it again, just to make sure you typed it correctly. When you are finished, the computer will give you a message saying “password changed” It may take several attempts before you come up with a password that the system will accept; be patient.

Alternatively, you can press “ctrl+alt+del” keys and press the “Change Password” button. You will be prompted to enter your old password (the one you want to change), your new password, and to confirm your new password. The same password is used for Windows, Linux, and e-mail. Changing your password in one system changes it in the other.

Commit your new password to memory. Do not share your password with others. See the computing staff if you forgot your password.

You may change your password at any time, and you should do so if you think the secrecy

of your password may have been compromised.

20.4 Your Email Accounts

You need to sign up for an email address on the UW computer network. Such an email account (called a UWNetID) will end with the string of characters `@u.washington.edu` (which we abbreviate by `@u` elsewhere). To sign up for a UWNetID, go to

<http://www.washington.edu/itconnect/accounts/>

and follow the instructions there. A UWNetID will be necessary for using **MyUW**, our Web-based university account management system which allows you, among other things, to sign up for your own classes and obtain class lists for the courses you teach.

In addition, you automatically get an email account on the department's network. This address ends with the string of characters `@math.washington.edu` (which we abbreviate elsewhere in the manual by `@math`). Any messages sent to this email address are automatically forwarded to the `@u` email server, so you need not check or manage your `@math` account separately. A message sent to either one of your email addresses will end up on the same server.

20.5 Web Pages

The Department has a Web page, with much useful information, and many professors and students have individual Web pages with content ranging from research interests and information concerning classes they are teaching, to hobbies and pet peeves. You are encouraged to create your own Web page.

Information on creating your own Web page and links to get you started with HTML may be found at

<https://depts.washington.edu/helpmath/moinmoin/moin.cgi/Help>.

20.6 Getting the Online MATH 124/5 Worksheets

The standard worksheets that are used for MATH 124 (or 125) are available from the MATH 124 Materials Website (or the MATH 125 Materials Website). These web pages were designed to make it easy for students and TAs to access the supplementary materials that have been created for the courses. Files are saved in HTML or PDF formats which any Web browser should be able to handle.

20.7 Getting Online Help With LINUX Commands

The `man` command allows you to view online help files; for example `man ls` will tell you about the `ls` command. The files can be tough to read and unfortunately you need to know

the name of the command to use `man`. Type `q` to exit a manual file. Type “`man man`” for more information about reading manual pages.

The `apropos` command returns a list of commands related to the keywords you typed after `apropos`. In looking for keywords, `apropos` considers each word separately and ignores the case (upper- or lower-) of letters. Words that are part of other words are also considered; thus, if you type `apropos compile`, `apropos` also will list commands that mention “compiler” in their man-page descriptions.

Another useful online-help command is `info`. Type `info info` and press the `Enter` key to start a tutorial. Non-experts may find `info` to be less intimidating than `man`, since `man` gives all the information there is to know about a command in a very dense fashion.

20.8 Spreadsheets, Classlists and Gradebooks

Some professors, or some of you, may want you to keep track of grades on a spreadsheet. The spreadsheet on the PCs is **Microsoft Excel**.

You can obtain obtain computerized classlists at MyUW,

<http://myuw.washington.edu/> ,

using the “Teaching” link on the left side of the page. (Recall from Chapter 19.2 that you must have a UW computer account – called a **UW NetID** – to access MyUW, and you can sign up for an account at <http://www.washington.edu/computing>.) To get a classlist you must be listed in the time schedule as an instructor for the course/section you are requesting. (If you are not so listed, see Math Student Services.) This web page always gives you up-to-the-minute information and can provide you with a classlist in many different formats – as a webpage, or mailing list, or simply a list of names (that can be imported into a spreadsheet).

We give instructions below for importing a class list into Excel.

20.8.1 Obtaining a Classlist for Excel

- Go to MyUW and click on the “Teaching” link. On the “My Class Resources” window that displays, select the term for the class you want to look at. (If a list of your classes does not appear, it means you are not listed as the instructor on the Time Schedule, and you should talk to Brooke Miller in Math Student Services to have this corrected.)
- Select “Class List” next to the class you want to download. This opens up a list of all the students in your class. Select “Download Class List (Excel)” at the top left.
- Now save the file to your computer, or to a subdirectory of your home directory on the math server.
- Start Excel, either by clicking on a desktop icon, or from the Start menu. In Excel, open the file using the Open command on the File Menu. In the Open dialog box, change the “Files of type:” option to either “All” or “Text files” to be able to see the file you saved. Change the “Look in:” directory to point to the directory you saved the file. Your saved file should appear in the file list. Select it and click “Open”.

- You can now modify the file and save it in Excel format (“**Save As...**” is an option on the sub-menu that appears when you click “File” on the menu bar.) The only things you will probably want to keep are the student number, name and email-address columns. You can click on the letter at the top of a column with the right mouse button and select “Delete Column(s)” to erase the entire column. (Or you can select “Hide” to hide the column from view, but be able to “Unhide” it later, using the Format menu. Ask for help if you need to do this.)

N.B. When using Microsoft Excel make sure you know where (the directory or folder) Excel is saving your classlist file. You want this file to be saved in your home directory on the file server so that it gets backed up. The Excel **Save** command saves your file to the local hard drive on your PC, and there is no backup of that disk.

20.8.2 GradeBooks

Since Winter 2009, University of Washington has made available GradeBooks as one of the Catalyst WebTools. Your instructor may wish to maintain grades in such a Catalyst GradeBook instead of in an Excel spreadsheet.

Log in at <http://catalyst.uw.edu/> using your UWNNetID, and follow directions — or ask your instructor and fellow TA’s for help.

Whether you use Excel or GradeBook to keep track of your students’ scores, make sure to make backup copies often and on a regular basis!

20.9 Other Programs

Lastly, being a math department, we have Matlab, Mathematica, Maple, R, Splus, Fortran (in the form of the GNU version with command `g77`), C++ (in the form of the GNU version with command `g++`), and others. Some of these have manuals in C-340 to help you along; if there’s software you’re used to and can’t find, email help@math. A list of software on Zeno and Windows systems is on the Web at:

<https://depts.washington.edu/helpmath/moinmoin/moin.cgi/ApplicationsOnZeno>