THE UNIVERSITY OF ARIZONA

Department of Mathematics
TA Training Manual
Fall 2015

Contents

Welcome

Welcome to the University of Arizona Department of Mathematics. Teaching is an important part of the mission of our department, and you are now an important part of that teaching mission. Your role as an instructor in this department is to do your best to help students succeed in math.

This manual and training, in conjunction with the Department of Mathematics Instructor Resource Manual, are intended to help prepare you for the critical first few weeks in your job as a first-time instructor in our department. We hope that you will find this material practical and helpful.

Enjoy your first semester of teaching at the U of A!

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Guiding Principles

This manual and the accompanying training were built upon a few guiding principles:

1. Our goal as teachers should be for 100 percent - 100 percent participation, 100 percent engagement, 100 percent effort, 100 percent on-task, 100 percent success. We must have this expectation if we hope to have students working to their full potential.
2. Most of the cognitive work in a class should rest on the students' shoulders.
3. The important question is not "What did I teach them?", but rather "What did they learn?" The appropriate measure of the success of any teaching activity is how well students are able to meet the objectives of that activity. We should establish and use observable and measurable criteria to assess our students' understanding, which is the best indicator of the effectiveness of our teaching.

Training Goals

Our goal is that by the end of this training, you will be able to:

1. Create clear objectives for student learning and behavior.
2. Structure class time and create a lesson plan with clear learning objectives that includes an outline of instructor and student activities and a realistic timeline.
3. Identify various forms of student engagement, and identify the advantages and challenges of each.
4. Identify ways to incorporate and increase student engagement in lesson planning.
5. Identify ways to incorporate ongoing assessment of student understanding in lesson planning.
6. Establish a plan for creating and maintaining an appropriate classroom culture.
7. Understand appropriate standards for professional conduct and demeanor.
8. Present a lesson in front of a group.
9. Become familiar with the resources available to instructors in this department, and know how to find university and department policies and procedures that relate to teaching.
10. Use various strategies for grading student work.
11. Examine your pre-conceived notions about teaching, and begin the process of thinking about who you are as a teacher.
12. Become familiar with various teaching activities that go beyond traditional lecture.

Essential Elements of Any Teaching Activity

- *Planning/objectives*

  All good lessons start with good plans, and good plans start with well-constructed objectives. In addition to a clear plan for what you want students to be able to accomplish by the end of the class period, you need to have a detailed outline of all of your teaching activities that will support those outcomes.

- *Student engagement*

  Engagement refers to all forms of student participation – listening, thinking, discussing, taking notes, problem-solving, answering questions, asking questions, etc. The goal of 100% engagement means all students, all the time.

- *Questions*

  Asking and answering questions is a critical component of teaching. Open-ended and probing questions are effective tools in assessing student understanding. Finding out what students already know and understand will be of the utmost value in answering questions, by helping students get from where they are to where they need to be.

- *Ongoing assessment of student understanding*

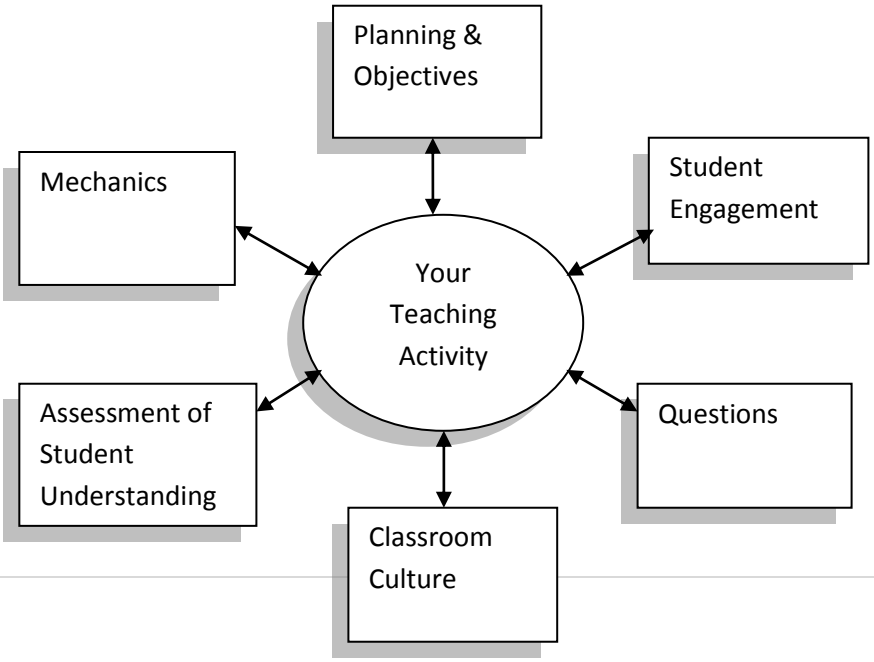
  Assessments come in many forms. By "ongoing assessment", we are referring to the daily activities that assist us in determining how well students understand concepts and how well they are able to meet the daily objectives. Assessment tools include observation of problem-solving, questioning, and quizzing.

- *Classroom culture*

  Classroom culture refers to the atmosphere of the class, based on the observable behavior and attitudes of the students and instructor.

- *Mechanics*

  The mechanics, or technical aspects of teaching include such things as organization, board work, clear and understandable speaking voice, and communication skills.



Establishing and Maintaining an Appropriate Classroom Culture

In order to create a positive classroom environment, it will be up to you to establish clear expectations for the class, both academically and behaviorally.

The First Day of Class

The first day or two of class are probably the most critical of the entire semester. These are the days when students form their opinions about you, about the course, and about what is expected of them. Therefore, it is important that you plan carefully for what you will do and say to create that first impression.

Exercise: What needs to be accomplished on the first day?

Brainstorm with your group to answer this question.

Important Things to Accomplish on the First Day

Below are some things that you will want to try to accomplish on the first day*.

- Establish a warm and welcoming, yet structured classroom environment
  - Greet students at the door as they walk in
  - Present yourself in a professional manner (e.g. physical appearance, materials organized, you are in charge, etc.)
- Introduce yourself and give students an opportunity to meet each other
  - If you have had teaching experience let them know, or your background in mathematics
  - You can start this early by emailing students before the semester starts
- Take careful attendance, and collect some written information
  - Write down pronunciations or nicknames students prefer
  - Hand out a form at the beginning of class that they fill out with background information you can look over later
- Start learning students' names
  - This is the most important management technique
  - Putting them in assigned seats for the first couple of weeks can really help with this
  - Try name tents, photos, or D2L profile pictures
  - Ask students to write something about themselves that will help you remember them
- Establish ground rules
  - Spend time the first day either discussing these or having students help to come up with ground rules
  - Make sure to review them the following class period or anytime you have a new student come in
- Establish the tone for 100 percent student participation and engagement
  - Have an activity the first day where they are responsible for working in pairs or groups sets the tone for the class. Having them come up with ground rules in pairs is a great start.

- Discuss course objectives and important policies
- Have students start engaging in the cognitive work of the course (i.e. do some math!)

*Note: Some of these things may be started BEFORE the semester starts.

Exercise: The First Day of Class

1. Discuss in your group how you will approach the first 20-25 minutes of the first day of class. In particular, how will you:
    - Introduce yourself
    - Provide an activity for the students to meet or get to know you and each other
    - Provide an opportunity for you to start learning names
2. Introduce yourself to a partner as you would to your class on the first day.

Setting Expectations

"I expect you all to be independent, innovative, critical thinkers who will do exactly as I say!"

College is predicated on the concept of academic freedom. High schools for most part take the approach illustrated in the above cartoon. Strange as it may sound, most of the students we will be teaching in the lower level mathematics courses will mistake academic freedom for there being no expectations. They mistake the freedom they now have in their time for not having to do anything. While one can take the philosophy that they will get it eventually, most instructors find that process is extremely painful for their students and for them. With a few simple statements at the beginning of the course, as well as consistently guiding them throughout the first several weeks, this transition can be much smoother for all involved.

When setting expectations it can be helpful to think of it in two ways: ground rules and procedures.

Ground Rules

Ground rules are different from course policies. These are the basic standards of behaviors that students must abide by in order to facilitate the cognitive work that will be done in class. Generally there should be only a few, stated in a positive way and ones that you are willing to enforce consistently. Ground rules are usually best created by some form of consensus with the class. The reasons for doing so include:

- Establish "buy in" from the students
- Establish a sense of shared responsibility for creating an atmosphere conducive to learning
- Establish the tone for interactive engagement for the rest of the semester

Examples of Ground Rules:

- Raise your hand to be called on
- Keep cell phones put away
- Be respectful (listen while others talk, appropriate language)
- Create original work

Procedures

Procedures refer to the specific activities and methods for accomplishing normal daily routines. These should be explained and practiced either the first several days of class or as each new activity presents itself in class. The reasons for doing so include:

- Spend time on the cognitive work instead of the administrative details
- Establish that instructor is thoughtful about the classroom environment and expects students to be as well

Examples of Procedures:

- Bring all materials to class including: book, notebook, calculator, pen or pencil.
- Use bathroom as needed or Ask permission to use bathroom
- Homework is turned into the folder within the first five minutes of class
- Head paper with name, date, class day and time on top right hand of paper
- Test days: all items are off desk, flip test over when completed

Exercise: What Are Your Expectations?

Write down 2-4 important expectations that you are going to have for your students, be they ground rules or procedures. Share with your table group when everyone is finished.

Professionalism

Professionalism is a key element of a positive classroom environment. It is important that you exercise professionalism in all your dealings with students and with other members of the department.

Fulfilling Job Requirements

- Remember that this is your job.
- Stay on pace with the syllabus. Don't get behind or significantly ahead of the
- Reply to emails/phone calls within 48 hrs if possible.
- Return graded papers within 2-3 class periods. If you find yourself falling behind, talk to your supervisor immediately to come up with a plan for getting back on track.
- Be to class on time and start class on time.
- Meet with the class on the specified days for the specified amount of time. You are required to hold class every day that it is scheduled, even if that is the day before Thanksgiving or Spring Break.
- Be prepared for more than enough content for the day's lesson.
- Keep accurate records. Keep a backup of all records.
- Stick to your policies throughout the semester. Policies constitute a contract that you make with the student. Failure to follow your policies can cause all kinds of problems down the road.
- Provide time for your students to meet with you outside of class. Office hours are part of your commitment to your students. You will need to be available during office hours, at the specified location.
- Make appointments with students who are unable to attend office hours.
- Dress appropriately for class.

Relationships with students

- Maintain a certain amount of distance in your relationships with students. The following is risky behavior you should avoid:
    - You should not be friends with, flirt with, or date your students.
    - Do not touch your students. This may be misinterpreted and unwanted.
    - Do not use rude language or tell inappropriate jokes or stories.
- Base your decisions and actions on fairness and consistency.
- If you need time because you or the student is upset, you can always tell the student that you will talk with them later.
- Harassment (both sexual and otherwise) is a serious and real issue. Be aware of the harassment policies of the university: http://equity.arizona.edu/education/harassment. Remember that harassment is judged by impact, not intent, and that you have a responsibility in the classroom to prevent it.

Dealing with student issues and parents

- Be respectful of students, and listen to them when they express concerns. Don't get defensive.
- Be sensitive to their situations, while keeping a professional distance.
- If a parent contacts you to discuss his/her student,contact Tina Deemer to determine the best course of action.
- Listen to your students. Be sensitive to their situation, while keeping a professional distance
- Be encouraging, yet realistic. Let students know where they stand in the class, but realize that, ultimately, the student must make his/her own decisions about things such as dropping the class.
- Keep in touch with your students. You can easily use D2L or UAccess Student – Instructor Center to email students about important announcements. Use a web page or D2L to post important class information, such as test dates, homework policy, homework assignments, etc.

Guidelines for working with supervisors and other faculty and staff

- Be respectful of everyone you encounter.
- Respond to calls/emails within 48 hours if possible, especially from your supervisor.
- Turn in tests/syllabi to supervisor with enough turnaround time (1 week if possible).
- Cooperate with all requests.
- Accept supervisor's comments for what they are – constructive feedback.
- You may need a teaching reference from your supervisor, so maintain a cordial relationship.
- Avoid repeatedly asking for special favors or exceptions to rules.

Know Your Resources

- You have many resources, including peers, teaching supervisor, graduate program director, Associate Heads for Instruction and Graduate Studies (Rob Indik, Dave Glickenstein), Director of Academic Services (Tina Deemer), Department Head (Ken McLaughlin)
- Try to have discussions with those over you prior to making any serious policy changes or unusual grading decisions

Creating Objectives

Objectives should describe skills or knowledge that a student should achieve as a result of educational activities. A clear learning objective should describe WHAT a student should be able to do, HOW (or under what conditions) the student should be able to do it, and specify the degree of accuracy required. Objectives should:

- Be student-centered; i.e. address what students should be able to do after the given activity
- Be specific
- Be observable
- Be measurable
- Include conditions (the "givens") when appropriate
- Include criteria for assessment when appropriate

You will need *action* verbs in order to create learning objectives. Below is a list of the six levels of intellectual behavior important in the learning process, as described by Bloom's Taxonomy, with a corresponding list of action verbs that might correspond to each.

Remembering	define, list, reproduce, state, acquire, label, list, match, name, outline, state
Understanding	classify, describe, explain, identify, recognize, select, discuss, convert, defend, distinguish, estimate, explain, extend, generalize, give examples, give in own words, illustrate, interpret, infer, paraphrase, predict, rewrite, summarize, restate, reorder, rearrange, represent, translate, transform
Applying	choose, demonstrate, illustrate, interpret, solve, use, apply, change, classify, compute, develop, discover, employ, manipulate, modify, operate, organize, predict, prepare, produce, relate, restructure, show, transfer
Analyzing	compare, contrast, differentiate, distinguish, experiment, analyze, break down, detect, deduce, illustrate, discriminate, infer, relate, separate
Evaluating	argue, defend, support, evaluate, appraise, assess, compare, conclude, contrast, criticize, describe, discriminate, explain, interpret, judge, relate, summarize, validate
Creating	assemble, construct, create, design, develop, write, formulate, categorize, combine, compile, compose, devise, explain, generate, modify, organize, plan, rearrange, reconstruct, relate, reorganize, revise, rewrite, summarize

Group Exercise: Rewriting a Learning Objective

"Understand domain of a function." What's wrong with this learning objective? How can we rewrite it to make it better meet the criteria stated above?

Exercise: Rewriting Learning Objectives

Rewrite each of the following learning objectives so that it satisfies the criteria stated above. Note that you may need to narrow the focus of the objective in order to do this; you may do this in whatever fashion you choose, or write multiple objectives to cover different skills. How will this objective be observed and measured?

1. Understand the definition of a function.

2. Find the equation of a line.

3. Give the formula for a parabola.

4. Introduce the idea of a logarithm.

Lesson Planning

Preparation is critical in the success of any class. Preparation means more than just "knowing the material" or "picking examples" – it involves thinking about what you want to happen in class, and specifically planning to make that happen.

A good lesson plan includes not only an outline of activities for the instructor, but also for expected student behaviors. One possible structure for lesson planning is to utilize a 2-column plan, which includes information about what the instructor will do and what the students will do. This type of planning keeps the emphasis where it should be – on the student.

Exercise: Filling in a Lesson Plan

During this activity, you will be filling in a partially completed lesson plan. Work out the examples indicated on the lesson plan first. Determine approximately how much time you will spend on each example, and how you will approach the example. Will you work through the example on the board? Will you do it interactively with questions? Will you ask students to work it on their own or in pairs/groups? Complete the details on the lesson plan provided.

Exercise: Creating a Lesson Plan

During this activity, you will be planning a lesson for the third day of class. Using the lesson plan outline provided, decide what material will be presented, and which examples you will use for this class period (50 minutes). Choose examples that will enable students to meet the stated objectives. Fill in times for each activity.

Directions:

1. Look at suggested course syllabus to determine the amount of material you will need to cover for the given class meeting.
2. Read relevant material in textbook/class notes. Review instructor notes.
3. Review the homework in the section, to determine type and level of questions the students should be able to answer by the end of the class period.
4. Select what definitions, terms, and examples you will present, and examples for students to do in class.
5. In your group, compare lesson plans. How will these examples help students to meet the objectives? How will the examples build on previous material? What difficulties will students face with these examples?

Student Engagement

The goal is 100 percent engagement from students at all times. We define student engagement as having one's attention, mind, or energy occupied with cognitive work relating to the class.

Some examples of student engagement:

- Thinking
- Listening
- Asking questions
- Answering questions
- Working problems individually
- Working on problems in pairs/groups
- Taking notes
- Think-Pair-Share
- Cold-calling
- Presenting to other students
- Quizzing
- Full-class discussion
- Polling

Note that some of these types of engagement are not observable.

Exercise: The When, What, How, and How Much of Student Engagement

For each type of student engagement, answer the following questions:

1. When (under what circumstances) might you use this activity?
2. What do you do and say to make sure this engagement happens?
3. How do you let students know your expectations (directions, course policy, class rules/norms of behavior, etc.)?
4. What percentage of students might be engaged during this activity?

Giving Directions

Some types of engagement may well be monitored by stated course policies or norms. For example, you may have established a protocol for students answering questions, or have pre-established groups. In most cases, however, you will need to give appropriate and clear directions in order to get full cooperation.

Here are some essential elements that you will want to include in directions:

1. The assigned group of people.
2. The specific task. Use action words like "decide," "list," "solve," "choose,", etc.
3. The expected product. For example, the students may be expected to report back to the class, hand in a sheet of paper, etc.
4. The time allotment. Err on the side of too little rather than too much. You can always give more time. You should shorten the time if most students are finished early.
5. The method of reporting out or sharing results with the class, if this is part of the activity.
6. Directions should be reiterated or clarified during the activity. You will want to give a time warning (like a 1-minute warning) to let them know it is time to wrap up.
7. A mechanism for bringing groups back to the full-class discussion.

Exercise: Restating Directions

Using the guidelines above, restate the following directions to be more specific, and provide an action for students to do.

1. Let's look at this on our calculators.
2. Here's an example from the class notes.
3. Work on this problem with some other students sitting near you.
4. Pair up.
5. Check your answers with someone nearby.
6. Find the answer to example 2.

Measuring Student Engagement in your Lesson Planning

We will use an "I/We/You" format for measuring the amount of student engagement:

- "I" refers to activities in which the instructor is doing most of the cognitive work. These include lecturing, demonstrating examples, providing directions, and summarizing.
- "We" refers to activities in which the cognitive worked is largely shared by instructor and students. These include activities like guided discussion or having students talk you through an example.

- "You" refers to activities in which the student is doing all or almost all of the cognitive work. Activities such as "seatwork", problem-solving in groups, "think-pair-share", and student board work are examples of this.

Exercise: Measuring Student Engagement in Your Lesson Plan

Review the amount of student engagement in your lesson plan. Classify each activity as an "I", a "We", or a "You". Calculate the percentage of I/We/You. If necessary, revise your lesson to include a higher percentage of We/You.

Assessment: Checking for Understanding

The question you must ask yourself is “what evidence do I have that they understand?” A true check for understanding must incorporate two elements. It must be both:

- Observable
- Measureable

Since we do not yet have the technology to read minds, we must have the student demonstrate in an observable way that they understand the problem. Only through this observation can we measure their progress.

Some Examples of Assessment Techniques

- Students paraphrase general understanding
- Polling/Voting
- Check a few students have them check others
- Instructional Games
- Presentations
- Students come to board to work a problem
- Ask a question to the class
- Students hold up paper/whiteboards in the air while you walk around and check
- 5 index cards labeled a,b,c,d,e and students hold up cards to show their answer to the problem
- Students write down their understanding of vocabulary or concepts before and after instruction
- Students complete a few problems at the end of instruction and the instructor checks them
- Interview a random sample of students as they solve problem
- In-class quiz
- Math Journals
- Concept maps

Questions – Your and Theirs

Asking Open-Ended Questions and Probing Statements

Wording questions in such a way that students are required to give more than a 'yes' or 'no' answer can be effective in teaching from many reasons. Asking a question that requires thought establishes the expectation that an instructor has for a student. If the student is immediately required to provide information from the start, they will understand that they will be expected to participate actively in the course. Using open-ended questions throughout the lesson not only allows the student to do most of the cognitive work, but also helps the instructor to check for the student's understanding along the way.

Exercise: Open-Ended Questions

Below you will find a set of questions that instructors commonly say that allow the student to answer 'yes' or 'no.' Generate a list of several open-ended questions that could be used in place of these.

- "Are there any questions?"
- "Do you know how to start this problem?"
- "Does everyone understand?"
- "Do you know what formula you are supposed to use?"
- "Is everyone okay with this? Can I move on?"

Using Open-Ended Questions and Probing Statements to Respond to Direct Questions

Often students ask instructors direct questions and it can be easy for an instructor to quickly answer the question the student has asked. The challenge is to respond to the student in a way that helps them come to their own conclusion about the answer to their question.

Exercise: Responding to Student Questions

Below are direct questions that students have asked an instructor. Write a response that you might use to direct the question back to the student. For example, if a student says "Did I get the right answer?", you could respond "How did you come to that solution?"

1. Student: "What is the formula for…?"
2. Student: "What do they want me to do?"
3. Student: "How do I input this into the computer?"
4. Student: "How do I solve this problem?"

Examples of Probing Statements and Open-Ended Questions

One way to accurately assess how well students understand an idea is to ask questions that you and the students expect should be answered. You should begin to develop a set of questions that you can use daily that are open-ended and non-rhetorical. Not only do these require more than a head nod, but the answer you "want" is not readily apparent from the way the question is posed.

- What are your thoughts on …?
- What can you do now?
- What are we trying to find out or do?
- How would you do that?
- Why would/did/can you do that?
- What do you already know about…?
- If you do that, how does it help you?
- What would be the next step?
- What do you mean by…?
- What kind of (equation/expression/function) is this? How do you know?
- In what way is this similar to or different from…?
- What are we assuming?
- Give me an example of a ….
- What do we need to know in order to…. ?
- If that is true, what would happen if…?
- How could we say that in a different way?
- What's given? What do I know about the problem?
- What are the variables? What relationships exist among the variables?
- What will the answer look like in the end?
- What are the methods we can use to solve this problem?
- What's the interpretation of the answer?
- What are the cues that will help me recognize this type of problem in the future?

Some questions adapted from 'Directing Discussion Back to the Group,' The Curators of the University of Missouri, 1997

Use Questions to Show Them How You Think About a Problem

Often, new teachers focus on the steps involved in solving a problem. For example, "To solve this equation, first we move all the terms to one side of the equals sign, then we factor and set each factor to equal to zero." While this may very well be correct, and may state very clearly what steps the student should follow to solve the problem, it is just as important, if not more so, for the student to understand WHY we are doing these steps. The thinking behind the steps in this particular example might be prompted by a series of open-ended questions: What kind of equation do I have here? How do I know that? What am I able to do with this equation that could help me solve it? If I do a certain process (such as moving all terms to one side of the equals sign), how does that get me closer to solving the equation? Why is it allowable to set both factors equal to zero?

These questions give rise to a way of looking "in between" the steps of a problem, where students have the most trouble. When you tell students to follow a pre-defined sequence of steps, most of them can do it. The real problem lies in starting the problem, or moving from one step to the next when you forget the algorithm, or knowing when you can apply a particular algorithm.

In order to reveal the thinking behind the solution, you will need to unpack your thought process about the problem. This is very tough for some instructors! It's been a long time since you learned this material, and maybe you have never even thought about how you think about it. In order to start the unpacking, turn off the auto-pilot, and go back to the fundamental questions you need to answer in order to know how to work through it. Use some of the questions on the previous page as a place to start.

Exercise: Practice Unpacking Your Thinking

Write down a step-by-step solution for this problem from Math 112:

> Shelby has $6.30 in nickels and quarters in her coin purse. She has a total of 54 coins. How many of each coin does she have?

Now write down a series of open-ended questions that will help reveal the thinking behind the problem.

When Things Go Wrong – Practice Progressive Intervention

The following is a brief list of intervention techniques that can be used when there is disruptive or inappropriate behavior happening in the classroom. Each of the steps is progressively more invasive; therefore it is best to start at the beginning and move to the next step if necessary. Depending on the severity of the infraction, or your ability to use one or more of the steps, you may want to skip one or more steps and start further down the list.

A Six-Step Plan for Progressive Intervention

STEP 1: Non-invasive (nonverbal) intervention

- Proximity
- Eye contact
- Signals (eyes on paper, silence, etc.)
- Self-interrupt

STEP 2: Positive group correction

- Brief, positive
- Reminder of what students should be doing, not what they shouldn't be doing
- E.g. "Everyone needs to be working on problem #1 now."

STEP 3: Anonymous individual correction

- No names mentioned
- Specific behaviors that need to be corrected are stated
- E.g. "Please remember to keep your eyes on your paper."
- E.g. "Two people are still talking. I need everyone's full attention."

STEP 4: Semi-private individual correction in class

- Stand near the student
- Speak quietly, but with conviction
- Clearly state what student should be doing

STEP 5: Public individual correction

- Keep it brief
- Keep things factual, keep emotions out of it
- E.g. "Holly, Please put your phone away."

STEP 6: Private correction outside of class

- State clearly and concisely the problem
- State the change that you expect the student to make
- Check for understanding by having them repeat back what they need to do

Remember that you have back-up. Your supervisor, the course coordinator, and other administrators in the department are here to help you with any problems you might encounter. You also have the Code of Academic Integrity and the Student Code of Conduct to fall back on.

Exercise: Practicing Progressive Intervention

For each of the following scenarios, describe how you could implement each of the five steps of progressive intervention. At which step would you start and why? What types of preventive measures could have been taken to lessen the likelihood of this behavior occurring?

1. Two students are texting each other during class and giggling.
2. After getting a test back, one student begins talking loudly to another student, swearing and saying that this test was not fair.

Once you reach Step 6, it's time to plan for the confrontation with the student. You may find these kinds of conversations difficult, so it's important that you be prepared and know exactly what you want to say. Here is one framework for such conversations:

- Remove the student from the room, or meet in your office
- State clearly and concisely the problem
- State the change that needs to occur
- Ask the student to repeat back the change that he/she needs to make
- Document

Exercise: Role-playing Confrontation

In this exercise each pair will be given some scenarios to discuss. Let's assume that you have exhausted Steps 1-5, and it's time to confront the student. For each scenario, discuss with your partner what you would say to the student. Be specific about the language you would use.

Now it's time to confront! Role-play your scenarios, taking turns playing the instructor.

Grading

Grading is an important aspect of teaching. It provides a mechanism to provide feedback to your students, to assess student understanding and to reinforce student learning.

Grading System

The University of Arizona has adopted a letter grading system that assigns points to letter grades. The following table represents the current grading system (2015-16 General Catalog for Undergraduates):

Grade:	Description:	Grade points:
A	Excellent	4 points
B	Good	3 points
C	Satisfactory	2 points
D	Poor	1 points
E	Failure	0 points

Types of Grading

Depending on the course, there are several types of grading that Instructors will be responsible for: grading of exams, projects and presentations, and written homework. All types of grading require the creation of a grading rubric.

Grading Rubrics

Rubrics provide students with feedback on their strengths and weaknesses, as well as, communicate instructor expectations to students. A grading rubric allows an instructor to assess student work fairly and efficiently.

When creating a grading rubric, first define the purpose of the assignment/assessment for which you are creating the rubric for. This consists of determining exactly what the assigned task is, does it break down into a variety of tasks and are these tasks equally important. You then must define what an exemplary student product looks like, as well as, work that falls below expectations. Finally, decide what kind of feedback you want to give students such that the feedback with help them improve their future work. Below are some suggestions when creating your grading rubric:

1. Create clear criteria for assigning points. Can it be observed, measured and is each criteria unique.
2. Construct the point structure according to the difficulty of the question or the number of steps required to solve the problem. Make sure that the point structure allows you to assign points in a systematic and consistent way. At the same time, make sure that enough points are allotted to the more basic problems to maintain a reasonable distribution of scores.
3. Try to enumerate the steps that students will earn points for (e.g. 1 point for grouping the first two terms together, 1 point for factoring out the leading coefficient correctly, etc.)
4. Use a well-refined scale. A problem that involves several steps should be worth several points.

5. Take off an appropriate percentage of points for small algebraic errors.
6. Define your rubric in terms of giving points, instead of taking them away. Think of this as the students earning points for various steps accomplished in the problem.

Limit the grading rubric to 1 page. Make sure it is simple and your grading criteria can be defended when students come to you with questions concerning their grades. When you are done with your grading rubric, analyze the rubric and seek opinions from other Instructors and/or TAs.

Grading Exams

In most courses of Mathematics, points students receive from exam grading contribute to the greatest percent of the overall course grade. When grading exams, instructors must consider the overall learning objectives to be assessed.

Exam formats vary, consisting of multiple choice questions and/or short-answer questions. If an exam is all multiple choice, the grading rubric is simple. Many instructors will use scantron student answer sheets and grade them using the scantron capability available through the Math Department resource center.

If an exam contains short-answer questions, a point-scale grading rubric is created that assigns point values to specific work that is required to answer the question posed. It must be consistent and points awarded that are consistent with the learning objective to be assessed.

Below is an example of a short-answer 9-point question from an Advanced Placement exam for Calculus

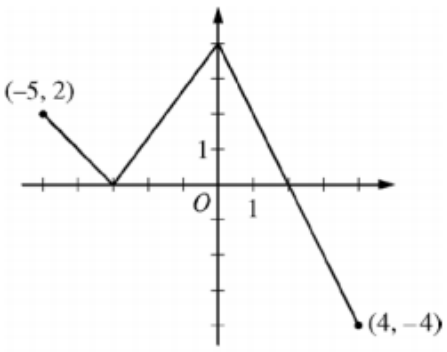
The function f is defined on the closed interval $[-5, 4]$. The graph of f consists of three line segments and is shown in the figure above. Let g be the function defined by $g(x) = \int_{-3}^{x} f(t)\,dt$.

(a) Find $g(3)$.

(b) On what open intervals contained in $-5 < x < 4$ is the graph of g both increasing and concave down? Give a reason for your answer.

(c) The function h is defined by $h(x) = \frac{g(x)}{5x}$. Find $h'(3)$.

(d) The function p is defined by $p(x) = f\left(x^2 - x\right)$. Find the slope of the line tangent to the graph of p at the point where $x = -1$.



Graph of f

(a) $g(3) = \int_{-3}^{3} f(t)\,dt = 6 + 4 - 1 = 9$	1 : answer
(b) $g'(x) = f(x)$ The graph of g is increasing and concave down on the intervals $-5 < x < -3$ and $0 < x < 2$ because $g' = f$ is positive and decreasing on these intervals.	2 : { 1 : answer 1 : reason
(c) $h'(x) = \frac{5xg'(x) - g(x)5}{(5x)^2} = \frac{5xg'(x) - 5g(x)}{25x^2}$ $h'(3) = \frac{(5)(3)g'(3) - 5g(3)}{25 \cdot 3^2}$ $= \frac{15(-2) - 5(9)}{225} = \frac{-75}{225} = -\frac{1}{3}$	3 : { 2 : $h'(x)$ 1 : answer
(d) $p'(x) = f'\left(x^2 - x\right)(2x - 1)$ $p'(-1) = f'(2)(-3) = (-2)(-3) = 6$	3 : { 2 : $p'(x)$ 1 : answer

BC. Note that the grading rubric point allocation is very specific to the student answer requirements.

Grading Projects/Presentations

Presentations are difficult to grade but once again, a rubric specific to the learning objective that is being assess is required. To help students focus, grading rubrics for projects and presentations should be provided when the project/presentation is assigned.

Below is an example rubric that can be used for grading oral presentations.

Category	Scoring Criteria	Total Points	Score
Organization (15 points)	The type of presentation is appropriate for the topic and audience.	5	
	Information is presented in a logical sequence.	5	
	Presentation appropriately cites requisite number of references.	5	
Content (45 points)	Introduction is attention-getting, lays out the problem well, and establishes a framework for the rest of the presentation.	5	
	Technical terms are well-defined in language appropriate for the target audience.	5	
	Presentation contains accurate information.	10	
	Material included is relevant to the overall message/purpose.	10	
	Appropriate amount of material is prepared, and points made reflect well their relative importance.	10	
	There is an obvious conclusion summarizing the presentation.	5	
Presentation (40 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	
	Speaker uses a clear, audible voice.	5	
	Delivery is poised, controlled, and smooth.	5	
	Good language skills and pronunciation are used.	5	
	Visual aids are well prepared, informative, effective, and not distracting.	5	
	Length of presentation is within the assigned time limits.	5	
	Information was well communicated.	10	
Score	**Total Points**	**100**	

Below is an example project grading rubric from Carnegie Mellon University.

Grading rubric for a Group Project
Project Proposal and the System Analysis and Design Deliverable Rubric

Component	Sophisticated	Competent	Not Yet Complete
Teamwork (25 Points)	The team worked well together to achieve objectives. Each member contributed in a valuable way to the project. All data sources indicated a high level of mutual respect and collaboration.	The team worked well together most of the time, with only a few occurrences of communication breakdown or failure to collaborate when appropriate. Members were mostly respectful of each other.	Team did not collaborate or communicate well. Some members would work independently, without regard to objectives or priorities. A lack of respect and regard was frequently noted.
Contribution (25 Points)	All requirements and objectives are identified, evaluated and competed. The deliverable offered new information or approach to the topic under discussion. Likewise, the application is based on stated criteria, analysis and constraints.	All requirements are identified and evaluated but some objectives are not completed. The deliverable offered some new information or approach to the topic under discussion. The application is reasonable; further analysis of some of the alternatives or constraints may have led to a different recommendation.	Many requirements and objectives are not identified, evaluated and/or completed. The deliverable offered no new information or approach to the topic under discussion. Few application considerations are analyzed and other factors were ignored or incompletely analyzed.
Subject Knowledge (25 Points)	The deliverable demonstrated knowledge of the course content by integrating major and minor concepts into the response. The deliverable also demonstrated evidence of extensive research effort and a depth of thinking about the topic.	The deliverable demonstrated knowledge of the course content by integrating major concepts into the response. The deliverable also demonstrated evidence of limited research effort and/or initial of thinking about the topic.	The deliverable did not demonstrate knowledge of the course content, evidence of the research effort or depth of thinking about the topic.
Supporting Material (20 Points)	All relevant information was obtained and information sources were valid. Analysis and design considerations were well supported by the information.	Sufficient information was obtained and most sources were valid. Analysis and design considerations were mostly supported by the information.	Insufficient information was obtained and/or sources lack validity. Analysis and design considerations were not supported by the information collected.
Composition (5 Points)	The deliverable was well organized and clearly written. The underlying logic was clearly articulated and easy to follow. Words were chosen that precisely expressed the intended meaning and supported reader comprehension. Diagrams or analyses enhanced and clarified presentation of ideas. Sentences were grammatical and free from errors.	The deliverable was organized and clearly written for the most part. In some areas the logic and/or flow of ideas were difficult to follow. Words were well chosen with some minor expectations. Diagrams were consistent with the text. Sentences were mostly grammatical and/or only a few spelling errors were present but they did not hinder the reader.	The deliverable lacked overall organization. The reader had to make considerable effort to understand the underlying logic and flow of ideas. Diagrams were absent or inconsistent with the text. Grammatical and spelling errors made it difficult for the reader to interpret the text in places.

Grading Homework

As with any other assignment/exam, a grading rubric must be developed for each homework assignment based on expected exemplar student performance and the learning objectives to be assessed. For online courses, homework assignments can be submitted via the D2L Dropbox utility. A grading rubric can be created specific to each assignment using the D2L Grading Rubric utility. For in-person class instruction, students are usually required to hand-in their homework assignments at the beginning of class. These assignments are graded and returned by the instructor in a timely manner.

Whether online instruction or in-person instruction, Instructors should provide students with homework guidelines and a general grading rubric for reference. Below is an example grading rubric provided to students to communicate overall homework expectations.

Points	Description	Characteristics
10	Excellent	Correct mathematics that is carefully thought out and thoroughly explained.
8-9	Good	Correct mathematics with an emerging but incomplete explanation
6-7	Average	Correct mathematics but little/irrelevant explanation or largely correct mathematics with an emerging explanation that shows understanding
4-5	Emerging	Work that has some merit but also has significant shortcomings in the mathematics and/or explanation
1-3	Credit for Effort	Work that shows some merit but is seriously flawed
0	No Credit	No work submitted or no serious effort shown.

Instructors also provide homework guidelines for homework assignments that contain other criteria, such as, neatness, organization and readability.

Suggestions for Grading in General

The following is a set of suggestions for grading in general. You will undoubtedly think of many others as you grade this semester.

1. Grade exams page by page, or even problem by problem, to ensure fairness in the distribution of partial credit. Do not attempt to grade one test at a time.

2. Write lots of comments on your exams/homework assignments providing feedback specific to each student's answer.

3. Mark points as a number out of a total (e.g. +2/3), rather than just giving a score (e.g. +2) or a number of points missed (e.g. -1). This helps students to understand how much of the problem they missed, and will help avoid complaints.
4. Write lots of constructive comments on exams/homework. Try to create a grading rubric for homework that enables you to focus more of your time and attention on the feedback, rather than on the assignment of points.
5. Mark up the paper enough so that you could recreate your thought process for the students, if it were necessary. Think of what your write on a student's paper as a sort of code, and use markings that are consistent from paper to paper. Some examples:
    - Circle or X out mistakes, put a check mark by steps done correctly.
    - If a problem is blank, put an X through the space. This prevents students from writing in answers after the fact and trying to get points for them.

Exercise: Grading Case Study Part I

In this exercise, you will be given examples of three students' work on a particular problem. Grade the student work on a 5-point and on a 10-point scale. Discuss the results with your group. Work on establishing a set of grading criteria for the problem and develop a grading rubric for a 5-point scale and a 10-point scale. Regrade with your group's established criteria. What impact did the creation of your criteria have on your grading?

Exercise: Grading Case Study Part II

In this exercise, you will be given examples of three students' work for a second problem. Together with your group, establish grading criteria for the problem given to you and define a grading rubric for a 10-point scale. Individually, use your criteria to grade three students' work. As a group, discuss and compare the results. Share with the class the overall outcome of the grading exercise, discussing your outcome grading results.

Mechanics

Boardwork

Writing on a board is a skill that you will hone over time. It's a bit harder than it looks to get a very neat and organized looking board. Many of our classrooms have white boards, but there are still some classrooms on campus that use chalk. You will want to check out your classroom ahead of time to determine which type of writing implement you will need.

When you look at a clean board, try to think of it as a blank canvas. You will be creating your "artwork" as you go through the class. You may want to divide up the board into sections – maybe 2, 3, or 4, depending on the size of the board. You can draw lines between the sections or just keep them in mind as you are writing. In each section, start writing in the upper left hand corner, and write as you would on a piece of paper, leaving the bottom ¼ of the board blank (otherwise students in the back will have a difficult time reading). Then continue writing in the upper left hand corner of the next section. Erase only by section – that will keep you from writing something and then erasing it too quickly.

Be sure that your writing is big enough for everyone in the room to read. This might mean that you have to ask on occasion. Get the students' perspective - look at your board from the back of the room once in a while.

If you are in a classroom with a white board, use different colors to emphasize different things. For example, if you are drawing two graphs on a single set of axes, you should probably use 3 different colors: one for the axes and one for each graph.

Communication Skills

Communication is critical in your success as a teacher. You can think of teaching as a two-way communication between you and the student. While you may be doing a lot of the talking in the classroom, the students are a big part of the communication equation – whether the communication is verbal or non-verbal. Strong communication skills will be very helpful in becoming an attentive and effective teacher.

Some Suggestions for In-Class Communication

- Speak loudly enough for students in the back of the room to hear you. This may mean projecting your voice more than you are used to doing.
- Speak slowly enough that students can follow what you are saying and take notes if needed. Don't be afraid to repeat things more than once for emphasis or clarity.
- Make eye contact with students, even those who are trying to avoid your gaze. Look directly at individuals, but don't direct your discussion towards a single person.
- Pay attention to body language. Students won't always tell you when they don't understand something, but they have a difficult time hiding it in their posture or the expressions on their

faces. Non-verbal cues are a very important form of communication during lecture, and they give you the feedback you need about pacing, difficulty, etc.

- Hone your listening skills.
- Give your students positive reinforcement when they speak in class. Try to find something in every answer that you or another student can build on.

Organization

Being organized in and outside of class will help you keep up with the work involved in teaching a class, and ultimately will make your life much easier.

Items you may want to take to class with you:

- Textbook, class notes
- Lesson plan with objectives and materials listed
- Student roster/attendance sheet
- Binder clips or folders for work that you collect, work that you are returning
- Calculator, calculator viewscreen panel if needed (can put equations in calculator ahead of time)
- Auxiliary teaching materials, such as visual aids and worksheets
- Extra paper, pencils, pens, etc.
- Dry erase markers (and/or chalk) and an eraser
- Transparencies and pens
- Homework assignment list with due dates, and homework solutions
- Printed grade sheet

Items to have available in your office during office hours:

- All materials that you take to class
- Extra dry erase markers or chalk, pens, and pencils for students
- Scratch paper – make sure that it is suitable for student use (no personal, private, or department information on it)
- Gradebook/printed grade spreadsheet
- D2L and/or Web page
- MyMathLab assignments, grades

Most of the supplies listed above can be obtained from the math department office.

Record Keeping

Having accurate records of student grades is absolutely essential. Even if you are generally not an organized person, it is important that you be organized in this aspect of your life.

The following are some suggestions for keeping track of grades.

1. Keep ALL of your grades, even homework and quiz grades, on a spreadsheet. This will make your job much easier at the end of the semester, and will help you avoid making arithmetic errors when calculating grades. This is especially true if you are going to adopt a homework policy whereby you drop a certain number of the lowest grades.
2. BACK UP grades after every edit.
3. Identify all grades with a descriptive title in your grade book. You should be able to identify the corresponding assignment for each grade in your records.
4. When you teach College Algebra, you will receive a grade spreadsheet from the office staff that you will use to record the test scores (and ultimately the final grades) for your class. Please make a back-up of this spreadsheet every time you edit it, and print out a copy. This spreadsheet will be turned in to the office staff after each test. Make a copy of the spreadsheet in a different file to keep track of homework/quiz grades.
5. Alphabetize all papers before you record grades. This will help expedite the process of recording grades, and it will also make turning back papers easier. It will also minimize the number of errors made by putting the grade on the wrong line in the grade book.
6. Devise some way of indicating an assignment that was not turned in, rather than leaving a blank space in your grade book. For example, you may want to put an "x" when an assignment was not turned in, and reserve "0" for assignments that were graded and received a zero. This serves a couple of purposes. First, it forces you to record something for every assignment for each student – this will mean fewer oversights in the recording process. Second, it keeps a student who actually turned in an assignment and received a zero from coming back later and claiming that you didn't grade the paper.
7. Always input grades immediately into the master grade spreadsheet. Do NOT keep grades written on a piece of scratch paper, with the thought of writing them in your grade book later.
8. Print out a hard copy of all grades after each test. Keep these in a safe place where you will be able to find them later.
9. If for some reason you lose some grades, avoid making the problem worse, and talk to your supervisor immediately. Do NOT make up grades, or otherwise try to "fudge" the records.

Section Policies

As a part of your particular teaching assignment, you may be required to write a homework policy. Even if the homework policy is common, you will need to supplement the common policy with your own section policies.

Department policy requires that each instructor assign and grade homework on a regular basis. Even if an electronic grading system such as MyMathLab is used, you should supplement online homework, as necessary, with other written assessments in order to ensure that grading reflects an emphasis on set-up, process, and notation, not just correct answers. The exact statement of this policy can be found in the Instructor Resource Manual.

In addition to being required, there are many reasons to assign and grade homework. Among the many purposes of homework are:

- To practice and apply the concepts presented
- To provide continuous feedback of progress to students
- To provide continuous feedback of students' comprehension to instructor
- To practice for the exam
- To make sure that students are keeping up with the class
- To ensure attendance of students

Writing a Section Policy

Policies are an important part of the student-teacher relationship. In essence, any policy that you give to students is like a contract for the class. You agree to abide by the policy as you have written it, while the student agrees to be subject to the terms of the policy. For example, if your policy states that MyMathLab will be used for your class, then you must agree to use it all semester and your students must agree to purchase access to MyMathLab if they stay in your class.

First and foremost, policies should ensure CONSISTENCY and FAIRNESS. In particular, policies should:

- Be thorough to cover (nearly) all eventualities
- Be clear and concise
- Be fair and consistent to ALL students, and be consistent with common course policies
- Be presented in written form
- Be created to reflect your expectations of the students
- Be something you can live with for the entire semester
- Follow the departmental guidelines for homework as spelled out in the Instructor Resource Manual

The goal is to close the loopholes as much as possible, but build in enough flexibility to allow for the unexpected.

Exercise: Drafting a Section Policy

Use this outline to draft a section policy.

1. Breakdown of points for homework and quizzes (if not specified by common course policy)
    - Homework vs. quiz
    - Electronic assignments vs. hand-written ones
2. When is homework due and how is it turned in? (in person, D2L dropbox, etc.)
3. Late assignments
    - How late is late?
    - Will they be accepted, and how are they turned in?
    - Are they worth full credit?
4. Absences – how will homework and quizzes be handled?
5. Format requirements
6. Expectations for academic honesty on homework
7. Calculation of points (if not specified by common course policy)
8. Grading of assignments (for anything not specified by common course policy)
    - Grading criteria or rubric
    - All problems or selected ones?
    - When returned?
9. Building in some flexibility
    - No extra credit
    - Replacement assignments?
    - Dropping a certain number of the lowest grades before averaging?
10. In-class expectations
    - Expectations for behavior
    - Expectations for in-class work
    - Procedural expectations

Sample Homework/Quiz Policies

The following are sample section homework/quiz policies. Please note that not every policy contains all of the elements described above, as your policy should. Use these samples to get ideas.

SAMPLE #1 (Supplement to Math 112 common homework policy)

Written work is assigned for each section of the textbook. It is due at the beginning of the class. Late homework will be graded but NOT counted. If you have notified the instructor of an unavoidable absence, turn in the homework on the DATE DUE. Be sure to include your name, section, date and my name on the paper. It is your responsibility to get the information regarding the new homework due for the next class.

Homework is assigned daily to practice skills and applications, and also to give both the student and the instructor feedback on the student's understanding of the material. Show your work for the problems, do the work in an organized manner and check your solutions. Use appropriate units on answers and use complete sentences where appropriate. Keep up with the pace and come in for extra help whenever needed. There are no opportunities for extra credit or to redo previous work, so please do not ask.

SAMPLE #2 (Supplement to Math 112 common homework policy)

Homework will be assigned regularly, and will be posted in D2L, along with deadlines. All assigned problems will be graded for completeness, correctness, and adherence to the requirements stated on the assignment. Homework will by due by 4pm on the due date, and *late homework will not be accepted for any reason*. Instead, the lowest 10% of the written homework scores will be dropped at the end of the semester.

Homework is an essential component of the course as the best way to learn math is by DOING math. Before attempting the homework problems, students are expected to read the appropriate section. Students' assignments are expected to be neat, and all work must be shown. Solutions must be checked or verified using an alternate method; e.g. just redoing the problem using the same method is not acceptable. Most homework problems will ask for a written explanation. In such cases, sentences (in English), which clearly and completely answer the question, are expected.

Discussion of homework problems ("working together") is encouraged, but each student is expected to write up his/her own solutions. Students are also encouraged to ask questions during office hours and to use the free tutoring available.

In addition to homework, quizzes may be given to assess student progress during the semester. Quizzes may be announced or unannounced, and make-up quizzes will only be given at the discretion of the instructor, and only for documented excused absences. Any quizzes given will be factored into the written homework score.

SAMPLE #4

Homework will be assigned regularly. Homework is an essential component of the course, and will help you prepare for the exams. Homework will be due at the beginning of class, usually on Monday morning and Wednesday morning. No late homework will be accepted. There will usually be a quiz at the beginning of class on Friday morning. The lowest 3 homework scores and the lowest 2 quiz scores for the semester will be dropped. Homework must be done in pencil (not pen). You may write on both sides of the paper, but multiple pages must be stapled. No fuzzy edges. Homework not complying with these policies may not be graded. Any solution or problem that is at all difficult to read may not receive any credit. Selected homework problems will be graded, and the total homework score will be scaled to be worth 75 points in the class. The total quiz score will be scaled to be worth 25 points in the class. Together, homework and quizzes will account for 100 points, which is one seventh of the total grade.

SAMPLE #5

Homework Policies:

Your homework grade will consist of two parts – homework done by hand and turned in to your instructor, and homework submitted electronically in MyMathLab.

Written work problems from each text section are posted in D2L and will be due two class periods following the one in which the section covered by that assignment is finished. Selected problems from each assignment (usually even-numbered ones) will be graded. In addition to the problems from the text, there will be in-class work that will count toward your homework grade.

A web-based program called MyMathLab (MML) will be used for some homework. Student accounts can be purchased on-line at mymathlab.com. (Provide specific directions on setting up and using account.) MML homework will be assigned on a regular basis and given a due date. You must complete the assignment by the due date in order to receive credit. You will be required to keep a notebook of your work for all MML homework. This will be collected periodically in class on pre-announced dates, and checked for completion. Each time you turn in your notebook, you will be given a homework grade that will be recorded and counted as a written assignment.

All assignments (both electronic and handwritten) will be worth 10 points. A few of the lowest scores from all of the homework assignments will be dropped, and the remaining scores will be averaged together to comprise your homework grade.

You are encouraged to discuss homework problems with me, with tutors, and especially with each other. However, you are expected to write up your own solutions. Most homework questions are to be handled in your instructor's office hours and in the tutoring room. On the day **before** the assignment is due, I will entertain questions for the first few minutes of class.

Procedures for Handwritten Homework:

- Homework is due at the beginning of the class period. No exceptions.
- Do your homework on regular 8.5 x 11" notebook paper. You may write on both sides of the paper. No fringes, please.
- Your name and the textbook section number should be written at the top of every page, with multiple pages should be stapled together.

- Each problem should be neatly written, with all intermediate steps included and the problem number clearly marked. Written explanations should be included whenever appropriate. Include units on answers. Graphs should be labeled, with the window clearly marked.
- You will not be given credit for problems that are not legible. If your handwriting is illegible, you will be given a warning, after which I will no longer accept your assignments unless they are legible.
- Because the few lowest homework scores will be dropped, late homework will not be accepted.

Procedures for Electronic Homework:

- All homework is due on the due date. No exceptions.
- Keep a careful record of your work in a spiral notebook. This notebook will be collected on a regular basis, so be sure that it is organized and legible.
- If you have questions about a MyMathLab problem, please bring your notebook with you to office hours or tutoring.
- If you have computer related questions (ex. unable to download a file, hardware compatibility problem, etc.) contact MyMathLab directly. You will find a link for technical support and a guide after logging-in.
- If you have math-related questions, contact your instructor.