

## **Mathematics As Problem Solving**

Math210381

Instructor:

Office hours:

Text: Curriculum and Evaluation Standards. National Council of Teachers of Mathematics, 1989, or 1999.

Course Objective:

1. To improve your mathematical problem solving ability, including reasoning.
2. To improve your understanding of some basics of mathematical concepts.
3. To improve your understanding of what mathematics is, especially as this is relevant to teaching mathematics
4. To improve your ability of mathematical communication (especially writing, talking, and listening)
5. To develop the habit of reflection on mathematics and mathematics teaching
6. To practice giving and receiving feedback.

Class Activities: Will include individual and group problem solving; reading from the text and other sources ( to be handed out); presentation of problem solutions; discussions of problems, reading and related experience; occasional short lecture; and keeping journal. (see last page of this handout for more details on the journal.)

What I expect of you: I expect you to

1. Attend class regularly. (Much of there is to get out of this class will take place during class times.)
2. Participate on class activities by volunteering to present solution to problems, listening carefully to other students' presentations of solutions, asking questions and offering constructive feedback on other students' presentations, contributing to class discussion, and participating constructively in group activities.
3. Manage your time working on problems so that you can work on problems, set them aside, come back to them, write up your solutions, and revise your write up.
4. Practice the problem solving techniques we discuss in the class, to incorporate them in your problem solving habits.
5. Learn from other students' methods and from feedback offered by other students or me, whether orally or in writing.
6. Keep your journal as outlined below, and use it in a way that best helps your individual learning needs and opportunities.
7. Do assigned reading and related assignments thoughtfully rather than superficially.
8. Take responsibility maintaining a balance of challenge and support that optimizes your learning in this course. (More on this later)

Policy on Collaboration: Since Unauthorized collaboration is considered academic dishonesty; it is important that you know what kinds of collaboration are and are not authorized in this class.

1. The following activities are not only authorized but encouraged:
  - Working on a problem with some one who has not yet solve the
  - problem.
  - Asking someone for a hint if you have given a problem a serious try and are stuck.
  - Giving a student who asks for help the smallest hint that you possibly can.
  - Asking someone to listen to and critique your ideas on a problem.
  - Listening to a student's ideas on a problem and critiquing them without giving away the solution.
  - Asking another person to read and critique your write-up of a problem.
  - Reading and critiquing a student's write-up of a problem, pointing out errors but not correcting major errors.
2. Unauthorized collaboration includes:
  - Asking someone to show the solution to a problem that is still due
  - Showing a student on the class a solution to a problem they have not yet solved
  - Copying, either word for word or by rewording, a solution that you have not played a significant part in obtaining. This includes a solution found in a book, a solution obtained by a student or group of students in this class, a solution originating in this class in a previous year, or any other source.
  - Writing up a solution together with someone else, even though you have worked out the solution together.

Portfolio: you are expected to keep and occasionally review a portfolio of your work related to this class (including problem solving, both turned in and not, graded exams, and any other evidence of your problem solving activities.)

Exams: There will be two mid-semester exams and a final exam.

Grading: Course grade will be based on all relevant information I have about you. Performance in class discussion and problem solving, homework turned in. Exams, journals, and any other information I have pertaining to your work in this class. I will try to give you the highest grade I can justify on the basis of available information. Homework and exams will be weighted about equally.

Journal: As part of your coursework for this class, you are required to keep a class-related journal. The journal will serve several purposes, including: encouraging you to reflect on your problem solving behavior and other topics related to mathematics and teaching, giving you practice writing about mathematics, providing feedback to me, and providing a means for me to give feedback to you. You are expected to write at least twice a week. What you should discuss in your journal is “

- your thoughts, feeling if you wish, your reaction to topics discussed in the class or in the reading, analysis of how you go about solving

problems (e.g. what strategies you most often use) and how you might do so better.

- Insight you have had into various mathematical concepts.
- Comparing and contrasting how you and other students go about solving problems
- Comparing and contrasting different solution to the same problem.
- How you have used ideas discussed in this class in other classes or other situations in your life, or how these relate to what we've discussed in class.
- How you might use what you learned in solving one problem in solving another.
- Asking questions about concepts you don't yet understand fully.
- Request for specific kinds of feedback
- Suggestions on how to improve this class.
- Discussions of what types of problems you like best, and why.
- Comments on your progress in any of the area of the course objectives.
- Information that might help me evaluate your performance in this class.

Note: You should not use your journal to record what went on in class ( except brief accounts to introduce your own reaction to this.) you are expected to write in Your journal outside class. If you wish to take class notes, you should keep these in a separate notebook or folder.

### Letter to students

Dear math student,

Welcome to mathematics as problem solving class. I hope this class will be rewarding for you.

I believe that learning best takes place when the learner has an appropriate balance of challenge and support. I have tried to design this course so that there are ample opportunities for both. However, since what is challenge and what is support varies from students to students, you will need to take responsibility for achieving a balance that is appropriate for you.

Most students find many of the problems challenging. If you do not, I hope you will challenge yourself by either finding other problems to solve, or pursuing other aspects of the course in a manner that is challenging to you. Possibilities include seeing how many ways you can solve each problem. Polishing your mathematical writing, focusing on observing other students' problems solving efforts and how this observation can help you become a better, trying to make your problem solving more efficient, learning to apply problem solving techniques discussed in this course to a course that is more challenging for you, reading the entire standards carefully and thoughtfully, polishing your oral presentation skills, learning to take criticism more constructively, learning to work better in groups, or even overcoming a fear of speaking in front of your peers. By all means, report on your efforts in your journal.

If, as is a little more likely, you find the problems extremely challenging, you will need to make an effort to develop and utilize the supports available. No single prescription works for every one, since what is supportive for one individual may in

fact be challenging for another (example: some students find feedback supportive, but others find it challenging), but possibilities include:

- Establishing a good relationship with one or more students in the class with whom you can work on problems (two heads are better than one!) or from whom you can obtain constructive emotional support. ( of course, you should be willing to expect to give as well as take in any such relationship.)
- Making an extra effort to learn to use the problem solving techniques discussed in class
- Using your journal to help work through your struggles.
- Practicing constructive self-talk. (Example: if you start thinking that you are “dumb” because you didn’t see on your own something that seems obvious after someone else explained it, remind yourself that happen to everyone, including very smart people.)
- Making maximum use of your own and others’ mistakes as learning experience.

In fact, the above suggestions are good ideas for anyone.

You will undoubtedly find the course frustrating at times; it is in the nature of problem solving to feel frustrated at least sometimes. Don’t let the inevitable frustration stop you. Learning to deal with it is an important part of learning to solve problems.

I just like to end my letter with a definition to a problem according to the Oxford English dictionary, “ **Problem**, A doubtful or difficult question; a matter of inquiry, discussion, or thought; a question that exercises the mind.” This may say if one has ready access to a solution schema for a mathematical task, then that task is an exercise and not a problem.

I look forward to seeing you learn and grow in this class

Sincerely