

MATH 103  
MATHEMATICAL IDEAS  
CSULB  
FALL 2008

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OFFICE: THU 10.30-11.30 OR ARRANGE

**Overview.** Why does mathematics pervade science? What is math, *really*? What is math *about*? Where does it come from? By considering specific cases, we'll study some of the ways that math arises and develops. One of our main goals is to appreciate both

- the internal charm, beauty, and satisfaction of doing mathematical work and
- the powerful tool that math provides for looking at the world.

**Geometry and Symmetry Project.** Our course is running as part of the *Long Beach Project in Geometry and Symmetry*. This is a multi-year effort to promote thinking that's rooted in perception and experimentation. You can read about the project at

[geomsymm.cnsm.csulb.edu](http://geomsymm.cnsm.csulb.edu)

The project's centerpiece is *The Geometry Studio* which we'll be using as a classroom.

Your critical comments—signed or anonymous—on the project or studio experience are welcome at all times. Toward the end of the semester, we'll invite you to evaluate your experience in the course.

**Getting involved.** A typical class-period will consist of working on the activities provided in the reader. You will work in groups of 2-4. From time to time we'll discuss matters as an entire class. The key to success in this course is **initiative**—a willingness to try things.

Much of our work will be *open-ended* in the sense that you won't solve a problem *completely*. Math really works this way—you're able to figure some things out, but there's still more to understand. This is like hiking in the mountains—you reach one peak and gain a nice view, but there are more peaks above you.

**Open studio.** At scheduled times—to be determined, the studio and its resources will be available to you **outside of class**. I encourage you make regular visits in order to meet with classmates, explore questions, develop a project, chat with Catherine, the Project Fellow, or just hang out and play.

**Getting stuck.** One of the inevitable results of this process is your being in a position of not knowing what to do next (often, what to do first). Such moments have great importance—you now have an *opportunity* to advance your understanding. Unfortunately (or fortunately?), there's no formula for how to proceed. You want to find a way of looking at the situation that will allow you to figure out something. Sometimes considering a simple example helps or doing some experiments or calculations. This takes effort and practice. The class will provide you with the chance to practice, the effort part is up to you.

Stuckness shouldn't be avoided. It's the physic predecessor of all real understanding. An egoless acceptance of stuckness is a key to an understanding of all Quality, in mechanical as in other endeavors. It's this understanding of Quality as revealed by stuckness which so often makes self-taught mechanics so superior to institute-trained men who have learned how to handle everything except a new situation.

—*Zen and the Art of Motorcycle Maintenance*

**Getting together.** One of the things that you *can* do when you're stuck is to work with classmates. Having access to another point of view can enhance your own. Maybe no one in a group knows what's going on completely. But, you might be able to draw from the know-how of each member in piecing together something that moves you forward. The classes are designed for this kind of work. I hope that you will extend your collaborations outside of class-time.

**Getting it.** Once you've found a way of understanding something, it's important to communicate it. Indeed, this further refines your understanding. You will do this both orally and in writing. Remember, I don't expect you to get everything—some of the topics we'll consider can be pursued at great length. Take pleasure in the understanding that you do achieve and keep trying.

**Math journal.** For weeks 2, 4, 6, 8, 10, 12, and 14 there will be an assignment to be written carefully. Typically, these will come from the reader. These "journal entries" will form the core of the course and will be due by **12N, Friday** of the given week. Much of this material will come from work in class. Frequent absences might produce a serious handicap. I urge you to **work with others** and to consider the problems at some length before asking about them in class. I also urge you to ask about the problems. The work represented in what you submit should be **your own**.

The mark for each assignment will consist of two pieces:

Effort    50%    The extent to which the work *appears*—admittedly, a subjective judgment—to be the result of honest effort.

Content   50%    Selected work that will be read carefully and commented upon.

You may select **one problem per assignment**—among the items that were read—to re-submit for up to 80% credit. (Submit the original with the rewrite.) Late work will be marked for up to 80% credit. The **deadline** for re-submissions is the **final day of classes**.

In addition, there will be suggestions for further thought and action. In these "Beyond the classroom" activities, I'll ask you to find examples of some idea that we've been working on or explore something a bit more. You may respond directly to these prompts or follow your own line of inquiry. I will mark this work as a "plus something" (up to 10) for that assignment. You may include examples or experiments in any journal entry—it needn't relate to what the particular topic is.

**About writing.** For many of you, a written solution to a math problem consists of some kind of calculation with a box around the answer. Of course, calculations matter. But, they usually mean something. What do the symbols, numbers, etc. represent in terms of the problem at hand? Calculations should have an *interpretation*. Except on rare occasions, your computations should occur as a *part* of your text.

Everything that you submit should be written in concise, clear sentences. Experiment with various styles as you develop your own. This takes a lot of practice. However, I'm convinced that the benefits easily repay the effort. Developing skill at concise and coherent communication will serve you in many endeavors.

**Presentation.** You will present to the class a solution of a selected exercise. This should be structured to take no more than ten minutes. Your grade will reflect your understanding of and insight into the math and your effectiveness in their communication. Many exercises will be marked for group presentation. For each assignment, I will circulate a sign-up sheet for the selected problems.

**Course project.** Find a topic to be examined independently. The reader contains a list of ideas, though I hope that you come up with your own topic. But, bear in mind that your project should have a *narrow focus* and *mathematical content*.

I encourage you to work in groups (2-3 members). Be advised that the standards for group work will be proportionally higher. Each project will be written up in 5-10 pages—length is not important. Clarity and creativity are what matter most.

You will present your findings to the class (10 minutes) during the the final exam time. If you work in a group, each member must make some contribution during the presentation.

By the 10th week you should have discussed a proposal with me. A number of useful items will be held on reserve for you to consult. A list of these appears in the reader. On several occasions, we'll have special Open Studio sessions dedicated to project work. If you're having trouble, please see me.

**WWW.** Materials related to the course will appear at the Geometry and Symmetry Project's website

[geomsymm.cns.m.csulb.edu](http://geomsymm.cns.m.csulb.edu)

Please make recommendations for things that you'd like to see on the site.

**Text.** *Patterns in Patterns: Looking at the World with Math*

**Coarse outline.**

<u>Week</u>	<u>Topic</u>
1-4 (Ch. 1)	Symmetry—the spice of mathematical life
5-6 (Ch. 0)	Some geometry and algebra that we'll use
6-10 (Ch. 2)	Spirals, numbers, snails, and pine cones
11-15 (Ch. 3)	Paper-folding
Final exam time (Wed 17 Dec 12.30-2.30)	Project presentations

### Getting evaluated.

Journal entries (Weeks 2,4,6,8,10,12,14)	50%
Problem presentation	20%
Course project and presentation	30%

To each individual part of your work I assign a mark 0-10. See below for an *indication* of what these marks mean.

10 . . . .	Clear, elegant, shows depth of understanding and special insight or creativity
9 . . . . .	Clear, shows understanding and some elegance and insight
8 . . . . .	Mostly clear, shows understanding, little elegance and insight
7 . . . . .	Somewhat clear, lacking depth of understanding, little elegance and insight
6 . . . . .	Some significant misconceptions or shortcomings
5 . . . . .	Highly significant misconceptions (about as low as it goes, with honest effort, )
0-4 . . . .	Shows little effort.

Here's a *rough* indication of how I will assign grades. These are **minimum** standards. The actual boundaries between grades might be lower than these, but won't be higher.

85-100%	A
75-85%	B
65-75%	C
50-65%	D

**Pass/Fail:** To receive a pass, you must achieve the equivalent of a C-.

### Key to comments on marked papers.

- a This needs a supporting **argument**.
- a? What's the **argument**—the line of reasoning—here?
- d **Describe** what's going on here.
- e **Explain** what you're doing here.
- h? **How** did you get this?
- i **Illustrate** what you're talking about—give an example, a picture, etc.
- m The **meaning** here isn't clear.
- p A **picture** would help here.
- s This is not a **sentence**.
- w **Wording** is awkward, confusing, etc. Meaning is unclear.
- y? **Why** is this so? What's the connection to what you've already said?
- ! Very nice. Something especially clear, insightful
- ? What this means or what you're doing is **unclear**. Where does this come from?
- X Something's wrong here—in concept or calculation.
- √ This is right—you have the idea.

## **Fine Print**

**Withdrawal** A copy of the School of Natural Sciences withdrawal policy is available from the Department Office. Note that it's different from the University withdrawal policy and the deadlines are earlier. Deadlines to which you should pay particular attention to appear below. Withdrawals from this course will be allowed only in accordance with University and College policies. Please be aware of the more specific and restrictive withdrawal policy for the College of Natural Sciences and Mathematics.

**Weeks 1-2.** Withdrawals will not appear on the student's permanent record.

**Weeks 3-8.** Withdrawals are permissible only for serious and compelling reasons. Academic progress unsatisfactory to the student is considered a serious and compelling reason during this period. Instructor and Department Chair signatures on the drop form are required.

**Weeks 9-12.** Withdrawals are permissible for serious and compelling reasons, but during this period, unsatisfactory academic progress is not considered a serious and compelling basis to drop a course. Circumstances must be shown that preclude the student from attending class or from any effective opportunities to study. In addition to the normal withdrawal form, a special form must be completed, and instructor and department chair signatures are required.

**Weeks 13-15.** Withdrawals are permissible only for serious accident or illness and involve a total withdrawal from the University. Detailed written documentation must accompany withdrawal forms. Instructor, chair, and college dean signatures are required.

**Disability** It is the student's responsibility to notify the instructor in advance of their need for accommodation of a disability that has been verified by the University.

**Cheating/Plagiarism** Cheating and plagiarism are in violation of the California Administrative Code, Title 5, Section 41301. CSULB has adopted a specific policy with respect to the violations of this nature (see the Bulletin or Schedule of Classes). Any student in violation of this code and policy in any assignment or examination related to this course shall be subject to the options specified in the policy statement. This may result in the student receiving a failing grade in the course or, in certain circumstances, being expelled from the University.