

MATH 410
HISTORY OF
MODERN MATHEMATICS
CSULB
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Overview

The influence of mathematics on modern intellectual and social history would be difficult to overstate. Why should this be the case? Where did the ideas of, say, analytic geometry or calculus come from? What mathematical and philosophical environments gave rise to them? What conceptual and even social obstacles did they face and how were these overcome? We'll explore these questions as well as others that occur to us along the way. Due to its significant historical role, our emphasis will be on developments associated with calculus. The object is not to provide a chronology, but a critical account of the conceptual emergence and working out of a profound achievement.

Class sessions

Beginning the fourth week, each time we meet a student-team will lead a critical discussion of a selected reading. This discussion should use the full class time. As the need arises, we'll establish the discussion-leader schedule for the upcoming several weeks. We'll follow a loose "rotation" of class members: no one leads twice before everyone has led once, etc. Depending on class size and the number of teams, each student should lead the discussion two or three times.

Primarily, we'll read original sources. This presents difficulties—mathematical writing in the 17th, 18th, and 19th centuries can be very different from what it is today. But, how else can you do justice to the historical development of ideas? The readings will appear online. For the most part, the reading of secondary treatments will be left to you. (The work by M. Kline, *Mathematical Thought from Ancient to Modern Times* can be especially useful.) You might find such material helpful in filling out historical background—something that can be especially useful to discussion-leaders.

Course-work

Class-discussions

When your chance to lead the class comes you'll work in **teams of two or three**. You should prepare a critical summary that stimulates the class to join in discussion. Biographical material is fine but should be stated briefly. You should place more emphasis on the **conceptual/theoretical framework** and **cultural/social context** of the work. If the reading has more than one part—for example, several authors, you might want to discuss each part individually.

You might find secondary sources helpful in providing historical and philosophical background. However, the emphasis for class-discussions should be on making sense out of what the original source has to say. For instance, we're especially interested in the following things.

- What's the problem at hand? How does the author approach it? What ideas and techniques are in use—both explicitly and implicitly? What's the intellectual, technological, and social context?
- What concepts does the reading rely upon? What's the author's *point of view*? What assumptions does the author make? What philosophical issues and historical questions does the reading suggest? What does the reading tell us about how math was done at the time?
- What are the crucial points in the development of an idea or theory?

- What new ideas are involved? How do they arise from and connect with existing notions and theories—particularly ones that we’ve seen in previous readings? What sort of conceptual change is taking place?
- What role does language and notation play in the attempt to explain things?
- In what ways did the ideas and developments in the reading influence subsequent mathematics?

Note: There can be a temptation to follow the reading in a strict linear succession. This approach tends not to be as illuminating as *first giving an overview* of the argument or theory that’s being developed and then examining the technical details.

After each occasion that you lead the class-discussion, you’ll receive comments and a mark. These will reflect

- the degree to which your treatment is clear and coherent—you needn’t understand everything (chances are that you won’t), but try to articulate what it is that you don’t understand. Are the concepts or the language difficult or unclear? Can you think of another way to treat things? Why doesn’t the author do it that way?
- your ability to engage and guide the class in thought-provoking dialogue.

Reading

As you read, try to carry on a *critical dialogue with the text*. It might help to keep a journal in which you record this dialogue. What do/don’t you understand? What seem to be the basic issues, problems, ideas, etc.? How does something connect to something else? What assumptions does the author make? Are there problems of language or concepts?

To gain a sense of intellectual and historical context, there are several good secondary sources from which you can benefit. I highly recommend that you consult at least one of these on a regular basis. Some additional material will be available through library reserve.

C. Boyer, *The history of mathematics*

H. Eves, *An introduction to the history of mathematics*

I. Grattan-Guinness, *Companion encyclopedia of the history and philosophy of the mathematical sciences*

M. Kline, *Mathematical thought from ancient to modern times*

Writing

Reflections. Each of these should be a **one-page** (typed, single-spaced) synopsis of the preceding week’s readings and discussions. Over the course of the semester, you’re required to submit **four reflections**. Rather than summarizing, concentrate on some notable or enlightening feature that arose from your reading and class interactions. It’s fine to consider just a single item. You needn’t “cover all the bases.” The paper is **due by the first class of the following week**.

Note: Excepting special circumstances (such as medical or family emergency), I will not accept late papers for the reflections.

Course project

On a topic of your choice, write a paper (5-10 pages), complete a project in another medium (such as a film or computer program), or develop a lesson-plan that includes a description and critical evaluation. There’s much freedom here and I encourage you to come up with your own undertaking. Your project should have **substantive mathematical and historical content**. Chronologies or

biographies in book-report style won't meet with a favorable response. After a few weeks a list that describes some possible topics will appear.

Be careful not to take on too large of a task—strive for a well-defined and **narrow focus**. To help avoid this and other pitfalls, I recommend that you submit a proposal (either oral or written) by the 10th week. You'll present your work to the class during the final exam time. As always, I invite you to collaborate with someone. (I recommend that you work in groups of two.)

On project research. As you put together a project, record the process by which you develop your ideas and thesis. What's the basic idea? What relevant material do you read? How do you refine your ideas as you read and think about things?

On group-work.

- Each member must make some contribution during the presentation.
- The standards for group work will be proportionally higher.

WWW

Materials related to the course (course description, assignments, list of reference materials) will appear at

www.csulb.edu/~scrass/Teaching

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

Coarse outline

Week	Topic
1-3	Background, mechanics, and coordinates
3-5	Infinitely large and small
6-8	Newton and Leibniz
9-11	The success of calculus: what it does
11-12	The failure of calculus: what it means
13-14	A foundation for calculus
15	The continuum of real numbers
16 (5-7, 16 May)	Project presentations

Evaluation

Reflections	30%
Discussion-leading	35%
Course project	35%

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

To each individual part of your work I will 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.

Credit/Nocredit: To receive credit, you must achieve the equivalent of a C.

Let me know if you're happy or unhappy about something.

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.
- 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.