Evolution of Mathematics at Keene State College is an integrative studies (our term for general education) course open to any student who has completed the two foundation courses (QL and Writing). Most students in the course are in fact pre-service mathematics teachers, but there are usually a half-dozen students who are not mathematics majors in the course.

Besides the information outlined in the attached documents, an interesting feature of the course is the inclusion of guest lectures by a librarian, a historian, a women's studies person (to pitch the feminist perspective) and similar folks who can add to the interdisciplinary nature of the course.

For anyone interested, I have further checklists to facilitate grading of the various course assignments. An email note to rjardine@keene.edu will get a prompt reply.

COURSE SYLLABUS   August 26, 2013
IIMATH310 Evolution of Mathematics
Instructor: Dick Jardine
Office: 88 Winchester Street, Room 203
Office hours: **M** 1:45 – 2:30 **T R** 9:45 – 10:30

But those aren't the only times I'm available to you! Please email to make an appointment at other times more convenient for you. And if you see my door open, you are welcome to come on in to talk about mathematics or anything of interest to you!
**Telephone:** (603) 358-2873   **Email:** rjardine@keene.edu

Web Page: http://sites.keene.edu/dickjardine/

Class meets: Science Center 360, MW 12:00 - 1:45

Text: *Math through the Ages: A Gentle History for Teachers and Others*, expanded edition, William P. Berlinghoff and Fernando Q. Gouvea, MAA, 2004.

Objective and Philosophy: This is a course on the evolution of mathematical ideas. Along the way you will learn about the key people and motivation responsible for the present state of the mathematics.
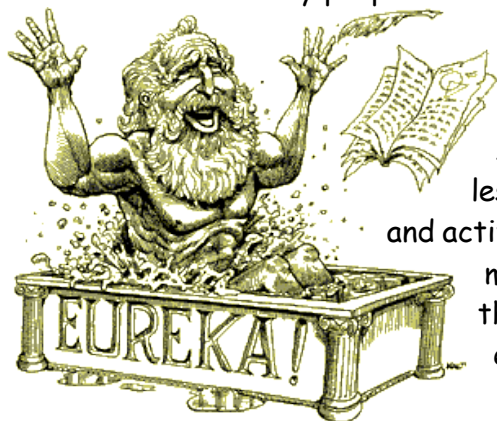
This is not a lecture course. You will learn the history of mathematics by becoming amateur historians. Much of the work in the course will be done in collaborative groups. There will be a substantial amount of reading from the course text, and for most lessons, the instructor will guide your reading with relevant questions and activities. Additionally, you will read original sources in the history of mathematics, so that part of your learning will be from the masters themselves (primary sources), not from secondary sources (for example, our textbook).

This is a mathematics course, and you will be challenged by the mathematical content of the course. Your instructor is willing and able to help you meet those challenges, as we explore and do the mathematics done by our predecessors. If your mathematical background is deficient in some areas, which is the case for *all* of us, we will fill in the gaps as we progress through the course.

This is a writing course. You will have to demonstrate your understanding of the history of mathematics by submitting compositions that are clear and concise. As an ISP course, you will be challenged to meet the standards for effective writing. There will also be a requirement to make oral presentations of your work. If you have difficulties with speaking before a group of your peers, let me

know and I will find alternative, and hopefully equivalent, ways for you to communicate your work in this course. The specific learning outcomes that are most important in this course are that you will:
- Describe the historical development of mathematical topics, including the role of significant contributors.
- Describe some of the historical and cultural influences on the development of mathematics, to include non-Western cultures.
- Investigate a topic in the history of mathematics, learning to differentiate between reliable and unreliable sources, and communicating the results in oral and written reports.
- Do mathematics in the manner of our predecessors, and in doing so develop a recognition for the advantages and necessity for present day methods and notation.
- Cross disciplinary boundaries to reveal new patterns and connections that reframe knowledge.
- Analyze the assumptions and actions of society from multiple perspectives.
- Examine national and international issues through artistic, philosophical, cultural, scientific, technological, economic, social and political lenses.
- Develop complex perspectives, positions, and arguments.
- Support complex perspectives, positions, and arguments.
- Use grammar effectively to communicate ideas.
- Use organization effectively to communicate ideas.

The latter six learning outcomes make this course an ISP interdisciplinary and writing course. You will be assessed throughout the semester on your ability to meet all of the outcomes.

Most of all, this is a fun course. It is very important to your instructor that you have fun along the way to learning the history of mathematics. Please let the instructor know what can be done to make the course better for you.

Grading: In order to accomplish those outcomes, we will do a great deal of reading and writing. Your grade will be based on my evaluation of your performance on the following requirements (subject to minor changes as the semester progresses):

Requirement	Course Points
Automathography	20
Historical biographies (short/long)	30/50
Homework	100
Attendance/participation	100
Essays, quizzes, in-class work	160
Book report	100
Original sources essays	120
Reflective summary	20
Final exam	100
Course Project	400
Total	1200

Achievement of the following levels of performance (percent of the Total) on the requirements guarantees that you will earn the corresponding course grade:

100-90	89-80	79-65	64-60	< 60
A-AB	B-BC	C-CD	D	F

Course Policies and Procedures:

Read the assigned portion of the text prior to coming to class. The instructor will make an honest effort to prepare you for the work you must do to prepare for class. Remember that as a college student, you are expected to spend two hours in preparation for each hour spent in class. Our history of mathematics text is not a history text! It is a mathematics text, and to read this text you must have a pencil and paper available and to read the text you must do the mathematics that the author describes using that paper and pencil. Expect to be stumped from time to time in that process, and please talk to your classmates and your instructor when you are stumped. You will find that they may be stumped, too, but working together, you will get it!

Come to class. Missing one class is accepted, but for each additional, unexcused absence your numerical course average will be decreased 10 course points. Contact me if you anticipate missing class. Remember that it is your responsibility to make up course work missed due to your absence.

Collaborative efforts are encouraged in this course. You will learn more working with peers than you will from the instructor. Be careful that any written work you submit for grade is well documented with footnotes or endnotes crediting all assistance received, other than from the instructor, in the completion of that submission. If there is any confusion, discuss the matter with the instructor prior to submitting the work. The college policy on academic honesty can be found on this web-page: http://www.keene.edu/catalog/acadpolicies.cfm.

Students with disabilities who may need classroom accommodations are encouraged to make an appointment with the Office of Disability Services (x2353). Please meet with me during office hours so that we can collaborate with the Office of Disability Services to provide the appropriate accommodations and supports to assist you in meeting the goals of the course.

In the event the College closes for a major disaster, all students are responsible for regularly checking their e-mail, voice mails, Blackboard, etc., for information on alternative course delivery procedures and course work submission. Alternative delivery methods are subject to change depending on the nature of the emergency. Students will be responsible for completing their assignments and ensuring that they have completed all of the core requirements for their courses before they will receive a final grade for the course.

If you have a cell phone, turn it off and put it away as it is not allowed for use in the classroom, even as a clock. Laptops can only be opened with permission of the instructor. Failure to comply with these policies will result in a diminished attendance/participation grade. More information about the instructor's course policies and up-to-date course information can be found on the course web page, found at http://keene.blackboard.com.

Most importantly, don't hesitate to discuss with your instructor any difficulties you have with course materials, methods, or policies. Try to have fun! It is important to your instructor that you have fun along the way to learning the history of mathematics.

LESSON SCHEDULE

Date	Lesson	Topic	Reading Assignment
August 26	1	Course introduction	None
August 28	2	Egypt and Mesopotamia	B&G pp. 1-14 Sketches 1, 9
September 4	3	Greek mathematics I Book review selection due	B&G pp. 14-24 Sketches 7, 14
September 9	4	Greek mathematics II Project proposal due	B&G pp. 14-24 Sketch 12, 15
September 11	5	Original readings I: Euclid	Course web page
September 16	6	Library presentation and tour	Course syllabus
September 18	7	Original readings II: Euclid	Course web page Sketch 13, 18
September 23	8	Original readings III: Archimedes	Course web page
September 25	9	Original readings IV: Apollonius & Diophantus, Eratosthenes	Course web page
September 30	10	Mathematics of ancient India and Arabia Annotated bibliography due	B&G pp. 24-32 Sketches 3, 10
October 2	11	Mathematics of medieval Europe; Original readings V: Fibonacci;	B&G pp. 32-34 Course web page
October 7	12	Mathematics of the 15th-17th centuries Project outline due	B&G pp. 35-42 Sketches 2, 4, 5, 8 11, 16
October 9	13	Original readings VI: Cardano	Course web page
October 14	14	History of complex numbers	Course web page Sketch 17
October 16	15	Calculus and applied mathematics I Project draft due; Writing workshop	B&G pp. 42-47 Sketch 6
October 21	16	Calculus and applied mathematics II Original readings VII: Euler	B&G pp. 42-47 Course web page
October 23	17	Historical book report presentations	

October 28	18	American Mathematics in the Age of Jefferson Historical book report presentations	Course web page
October 30	19	American biography presentations	Course web page
November 4	20	American biography presentations	Course web page
November 6	21	Course project presentations	Course web page
November 13	22	Course project presentations	
November 18	23	Mathematics history from a feminist perspective Non-Euclidean and projective geometry	Guest speaker Sketches 19, 20
November 20	24	Rigor and professionalism Writing workshop	B&G pp. 47-52
November 25	25	Abstraction, computers, new applications, and mathematics today Course project due	B&G pp. 53-60 Sketches 23, 24, 25 Course web page
December 2	26	History of probability and statistics	Course web page Sketches 21 & 22
December 4	27	Original readings VIII: Probability/Statistics; Course review	Course web page

Final exam: Wednesday, 1:00-3:00 pm

IIMA310 Evolution of Mathematics Course Project

1. The course project is *the* major effort in our course, is expected to be a significant product, and is worth one-third of the course grade.

2. The project can be done as an individual or group (two persons) effort. The product of a team effort will be expected to be more substantial than that produced by an individual and approved by the prof.

3. The project is due as indicated below, but there are intermediate results due on earlier dates. The final project submission will consist of both a written report and a 5 to 10 minute oral presentation. The scope of the written report depends on the nature of the project undertaken. Web pages, videos, podcasts, etc., are encouraged as part or all of the project submission.

4. Project proposals are due not later than the date indicated below. The proposal will include an overview of what you hope to accomplish in the project and your estimate of the nature of your final submission and presentation. The proposal should be at least a couple of paragraphs but not much more than a page in length.

5. It is important that your project be on a subject of interest to *you*. Suggestions for project topics, based on both my and your preferences, as I understand them, include:
- The history of a branch of mathematics, for example, calculus, game theory, or graph theory;
- The role of religion on the development of mathematics;
- A historical & interdisciplinary perspective: Mathematics and Music, or Mathematics and Art;
- Women and mathematics: a feminist perspective on the evolution of mathematics;
- A psychological profile of some famous mathematicians;
- An assessment of the historical mathematical content of children's literature;
- Mathematics and the Maya (or Japan, or China, or Islam, or some other culture);
- Errors of famous mathematicians;
- Contributions of a particular mathematician, for example, Alan Turing;
- Calendrical mathematics;
- Using *Geometer's Sketchpad* or other software to demonstrate early geometric results;
- Astronomical mathematics (spherical geometry/trigonometry) origins;
- History of fractals and mathematical chaos;
- Classroom module introducing history on a mathematical topic in the schools;
- Historical impact of KSC on mathematics education in New England;
- History of the KSC mathematics department;
- Early American mathematicians;
- The mathematics of cryptography and code-breaking;
- The mathematics of the sun-dial;
- A more lengthy original source investigation;
- A topic from the history of mathematics education;
- A module incorporating the history of mathematics to advance learning of a school mathematics topic;
- Other topics approved by your instructor;

Course project milestones:

Task	Points	Date due	Comments
Project proposal	20	September 9	Talk with your professor; Do the research!
Annotated bibliography	30	September 30	Do the research and the reading.
Project outline	50	October 7	The more detailed the better! Include the annotated biography and additional works used/cited.
Project draft	50	October 16	No changes in project subject or scope after this point. Include full citations.
Project presentations	50	November 6	All submitted on the 6th
Project submission	200	November 25	Breathe a sigh of relief!

Biographical Sketch Presentation Assignments

A graded requirement for IIMATH 310 will be the submission and presentation of a brief essay (biographical sketch) about a person prominent in the history of mathematics. The biographical sketch should contain information about the time period in which the person lived and worked, the major contributions of the person, and, if possible, any interesting (humorous?) anecdotal information. The written essay (sketch) should be at least a couple of paragraphs and preferably not more than one page in length, certainly not more than a couple of pages. The oral presentation should take 5-6 minutes of class time, certainly not more than 5 minutes. *Important*: both the written essay and the classroom presentation **must** contain and briefly explain a mathematical relationship, figure, or graph that is representative of the mathematician's contribution. Remember that your instructor is available for assistance in this endeavor, and full documentation of resources used is required. At least one web source and one print source is required for full marks.

Lesson Number	Topic	Student
3	Thales	
3	Pythagoras	
3	Eudoxus	
6	Euclid	
8	Archimedes	
9	Diophantus	
4	Pappus	
4	Hipparchus	
4	Ptolemy	
4	Hypatia	
9	Apollonius	
9	Eratosthenes	
10	Brahmagupta	
10	Bhaskara I and II	
10	Al Khwarizmi	
10	Ummar Al Khayammi	
11	Gerbert D'Aurillac	
11	Nicole Oresme	
11	Leonardo of Pisa	
11	Johannes Muller	
11	Robert Recorde	
13	Nicolo Tartaglia	
13	Girolamo Cardano	
13	Rafael Bombelli	
12	Pierre Fermat	

12	Rene Descartes	
12	Francois Viete	
12	Marin Mersenne	
14	Galileo Gallilei	
14	Johannes Kepler	
14	Bonaventura Cavalieri	
15	Blaise Pascal	

Lesson Number	Topic	Student
15	Christian Huygens	
15	Isaac Barrow	
15	Isaac Newton	
15	Gottfried Wilhelm Leibniz	
16	Bernoulli (the family)	
16	Maria Agnesi	
16	Emilie De Chatelet	
16	Pierre Simon Laplace	
16	Euler	
16	Joseph Louis Lagrange	
16	George Berkeley	
17	Janos Bolyai	
17	Nicolai Lobachevski	
17	Bernhard Riemann	
17	Carl Friedrich Gauss	
17	Augustin Louis Cauchy	
17	Albrecht Durer	
17	Gerard Desargues	
17	Jean Victor Poncelet	
17	Blaise Pascal	
18	David Rittenhouse	
18	Nathaniel Bowditch	
18	Benjamin Banneker	
18	Ferdinand Hassler	
18	Benjamin Franklin	
18	Robert Adrain	
18	George Baron	
18	John Farrar	
18	Andrew Ellicott	
20	Richard Dedekind	
20		
20	Giuseppe Peano	
20	Georg Cantor	
20	Felix Klein	

20	Bernhard Riemann	
20	Henri Poincare	
20	Evariste Galois	
25	Sophie Germain	
25	Emmy Noether	
25	Sonya Kovalevsky	
25	Niels Abel	
26	Christian Huygens	
26	Jakob Bernoulli	
26	Simeon Denis Poisson	
26	Abraham DeMoivre	
26	P. L. Chebyshev	
26	Florence Nightingale	
26	John Tukey	
28	John Graunt	
28	Lambert Quetelet	
28	Francis Galton	
28	Francis Edgeworth	
28	Karl Pearson	
28	William Gossett	
28	R. A. Fisher	
28	W. Edwards Deming	

IIMATH310 Evolution of Mathematics Book Review

The purpose of this assignment is to get you started on the way to reading "popular" books involving mathematics, and in particular the history of mathematics. The specific assignment is for you to select a book, read the book, and then report on the book.

 Your report will actually have two components: an oral presentation and a written report. The written report need not be more than a couple of pages long, though you may need more space to do the mathematical explanation. You may put that in an enclosure/appendix to your report if you wish. Attached is a checklist that I will use to grade the written report, so use that to ensure your report has the right stuff. The oral presentation will be 5-10 minutes in length, and should be well-rehearsed prior to presentation in class. A *PowerPoint* , or similar software product, presentation is suggested but not required.

In both the written and the oral reports, emphasis is placed on your reflection of what you learned about the history of mathematics while reading the book. Take care to carefully describe a specific mathematical example presented by the author(s) in a way which demonstrates that you fully understand the topic you chose. As always, drafts are welcomed so you can receive feedback on whether or not you are on the right track.

History Book Review Checklist

1. Does this essay have the correct content:

a. Brief overview of the mathematical theme of the book	0	3	6
b. Detailed explanation of an example of the mathematical content	0	3	6
c. Reflection on what was learned about the history of mathematics or the history of mathematics education	0	3	6

2. Is the essay well-written:

a. Clearly identifiable introductory and summarizing concluding paragraphs, with positive/negative recommendation	0	2	4
b. Well-organized with coherent sentence and paragraph structure, smoothly integrating the mathematical content.	0	2	4
c. Minimal spelling, capitalization, punctuation and/or grammatical errors	0	2	4

General comments:

BOOK REVIEW ORAL PRESENTATION CHECKLIST   Name _____

	points	

INTRODUCTION:

a. Introduce self	0	1

b. Provide overview of talk	0	2

PRESENTATION:

a. Brief overview of the book	0	2

b. Mathematical content of the presentation	0	2	4

c. Reflection on the mathematics history learned	0	2	4

3. CONCLUSION: Summarize & recommend or not recommend the book with justification	0	2

4. ORGANIZATION AND STYLE:

a. Timing (5-10 min)	0	1

b. Quality of visuals	0	1

c. Clarity of communication, eye contact	0	1

d. Apparent preparation	0	2

BONUS: Creativity, appropriate humor	0	1	2

General comments:

Suggested Books

For the book report, the list of potential books is nearly infinite. I've listed some here, but there are many, many others that will work. The key is to pick a book early, get the approval of your instructor, and then read the book at your leisure during the early part of the semester. The oral and written reports are to be ready for submission at the due date indicated in the course syllabus.

Almost any book listed here:

> http://store.doverpublications.com/by-subject-science-and-mathematics-mathematics-history-of-mathematics.html

Almost any book by:

David E. Smith	Florian Cajori	William Dunham	Morris Kline
Eric T. Bell	Carl Boyer	Paul Nahin	Eli Maor
Thomas L. Heath	Ian Stewart	Keith Devlin	John Derbyshire

Great Fueds in Mathematics, Hal Hellman, Wiley, 2006.

Equations from God, Pure Mathematics and Victorian Faith, Daniel Cohen, Hopkins, 2007

The World of Maria Gaetana Agnesi, Mathematician of God, Massimo Mazzotti, Hopkins, 2007

The Unfinished Game, Keith Devlin, Basic Books, 2008.

The Lady Tasting Tea, David Salzburg, Freeman, 2001.

The Mathematics of the Heavens and the Earth: The Early History of Trigonometry, Glen Van Brummelen, Princeton, 2009.

The Ellipse: A Historical and Mathematical Journey, Arthur Mazur, Wiley, 2010

Archimedes: What Did He Do Besides Cry Eureka? Sherman Stein, MAA, 1999

The Saga of Mathematics, Lewinter & Widulski, Prentice Hall, 2002

Statisticians of the Centuries, Heyde & Seneta, Springer, 2001

James Joseph Sylvester, Jewish Mathematician in a Victorian World, Karen Parshall, Hopkins, 2006

The Universe in Zero Words , Dana Mackenzie, Oxford University Press, 2012