

MA 330 001, History of Mathematics¹ University of Kentucky, Fall 2014

1. General Information

Instructor: Dr. Benjamin Braun

Course Webpage: www.ms.uky.edu/%7ebraun

Email: benjamin.braun@uky.edu

Office Phone: 257-6810

Class Time/Location: CB 341, MWF 1:00-1:50PM

Office Location/Hours: POT 831. Meetings in person are by appointment. Online availability via piazza.com, see Online Discussion Board section.

Required Course Texts:

Books:

- *Journey Through Genius: The Great Theorems of Mathematics*, 1991, by William Dunham. ISBN-10: 014014739X
- *The Crest of the Peacock: Non-European Roots of Mathematics*, third edition, 2011, by George Gheverghese Joseph. ISBN-10: 0691135266
- *Loving and Hating Mathematics: Challenging the Myths of Mathematical Life*, 2011, by Reuben Hersh and Vera John-Steiner. ISBN-10: 0691142475

Articles:

- "Is Math a Gift? Beliefs That Put Females at Risk," by Carol Dweck
- <http://www.stanford.edu/dept/psychology/cgi-bin/drupal/system/files/cdweckmathgift.pdf>

2. Course Description and Student Learning Outcomes

We will begin with three quotes.

I learned a great deal from taking this course; however, I do not think what I learned was exactly what I was supposed to learn.

FORMER MA 330 STUDENT

The most important thing I learned in this class is that I have the ability to comprehend things that are very difficult, and have not been taught to me.

FORMER MA 330 STUDENT

One of the disappointments experienced by most mathematics students is that they never get a course on mathematics. They get courses in calculus, algebra, topology, and so on, but the division of labor in teaching seems to prevent these different topics from being combined into a whole. In fact, some of the most important and natural questions are stifled because they fall on the wrong side of topic boundary lines. . . Thus if students are to feel they really know mathematics by the time they graduate, there is a need to unify the subject.

Mathematics and its History

JOHN STILLWELL

¹I reserve the right to change or amend this syllabus at any time for any reason.

It isn't at all clear what a course on the History of Mathematics should be. Is it a history course with some math in it? Is it a math course where historical tidbits are tossed in? Should it only cover mathematics that students have already seen, or only mathematics that is new to them, or a blend of both? Should it be an easier course ("the last requirement for my math minor") or a challenging one ("now I really understand Lebesgue integration")?

For what it's worth, I don't have good answers to these questions either. What is more clear is what a History of Mathematics course should do. This course should inform our vision of how mathematics develops, and should allow us to create for ourselves a cohesive picture of mathematics. It should establish connections between mathematics and the non-mathematical world, helping us seek to understand what drives our intellectual values, both individually and collectively. It should cause us to ask deep questions: How have our intellectual values changed over time? What makes a theorem important? What does that even mean? What makes a theorem beautiful? Or useful? What is the role and purpose of proof in mathematics? How do we as mathematical learners and practitioners fit into the contemporary culture of mathematics? These are perhaps the most fundamental questions to ask in a history of math course, because the mathematicians whose work we are studying were inspired by their own answers to these questions.

Motivated by these questions, the student learning goals for MA 330 regard understanding of mathematical content and development of mathematical practices.

Students in MA 330 will deepen their understanding of

- (1) Greek, Egyptian, and Mesopotamian mathematics, with a focus on arithmetic, number theory, Euclidean geometry, and rhetorical algebra;
- (2) how the Islamic mathematicians blended these mathematical traditions with traditions from the Indian subcontinent;
- (3) how algebra and calculus were initially regarded and practiced, and how this differs from contemporary use;
- (4) the development of mathematical approaches to infinite processes; and
- (5) the role, purpose, and development of mathematical proof.

Further, students in MA 330 will

- (6) enhance their reading, writing, and oral communication skills in mathematical contexts;
- (7) increase their persistence and use of self-monitoring when working on mathematics;
- (8) develop an understanding of the global nature of mathematical culture, and the importance of cultural interactions in mathematical history; and
- (9) reflect on contemporary mathematical culture, their place in it, and their mathematical values.

It is important to remember that we cannot reach these learning outcomes completely on our own, as shown by the following quote.

Within these [mathematical] communities of practices, there are well-established patterns of behaviour to which I have drawn attention [in this study]. The most important is that mathematics is no longer seen, by the majority of mathematicians, as an individual activity and all of the reasons which [the mathematicians in this study] gave for collaborating can be found in the education literature with respect to utilizing group work in classrooms. The experiences of these mathematicians help, I think, to emphasize the flow and inter-dependence in meaning making between the

socio-cultural formulations and individual acquisition. Learning is *neither* wholly individual *nor wholly* social.

The Practices of Mathematicians

LEONE BURTON

3. Class Structure

Our activities in this course will directly serve the student learning outcomes listed above. Class time will usually not be spent in a formal lecture style. Instead, we will spend time in class:

- discussing the readings with the entire class,
- working through math in the readings in groups,
- working on problem sets related to the readings in groups,
- presenting problem progress and solutions at the board, and
- offering and receiving constructive criticism regarding our ideas and understanding.

You should expect to spend *at least* six hours per week outside of class for MA 330.

4. Online Discussion Board

MA 330 Online Discussion Board:

<https://piazza.com/uky/fall2014/ma330/home>

Piazza is an online discussion board where we can collectively ask and answer questions. While you are expected to participate on the discussion board, *the mathematical content on the discussion board is not part of your course grade*. The purpose of the discussion board is to allow us a place where we can make mistakes, introduce errors, head down blind alleys, etc, as a community of learners in a common search for understanding. When you are asking questions, answering questions, giving partial answers to questions, suggesting ideas, etc, please keep at the front of your mind the following quote.

Learning is least useful when it is private and hidden; it is most powerful when it becomes public and communal. Learning flourishes when we take what we think we know and offer it as community property among fellow learners so that it can be tested, examined, challenged, and improved before we internalize it.

Taking Learning Seriously

LEE SHULMAN

5. Tentative Schedule

Next to each date is listed the material that should be read prior to class. We use the abbreviations JTG = Journey Through Genius, Crest = The Crest of the Peacock, and LHM = Loving and Hating Mathematics.

Aug 27: First Day of Class

Aug 29: JTG: Preface

Crest: Preface to the First Edition

LHM: Introduction

Dweck article: read all of it

Course Syllabus

ASSIGNMENT DUE

Greek Mathematics

Sept 1: No Class: Labor Day Holiday

Sept 3: JTG: Ch 1, pgs 1–17, start chapter, end at “Great Theorem”

Sept 5: JTG: Ch 1, pgs 17–26, start “Great Theorem,” complete chapter.

Sept 8: JTG: Ch 2, pgs 27–44, start chapter, end at “Book I: Parallelism. . .”

QUIZ

Sept 10: JTG: Ch 2, pgs 44–53, start at “Book I: Parallelism,” end at “Epilogue”

ASSIGNMENT DUE

Sept 12: JTG: Ch 3, 61–75, start chapter, end at “The Final Books. . .”

Sept 15: JTG: Ch 3, 75–83, start at “The Final Books. . .,” complete chapter

ASSIGNMENT DUE

QUIZ

Sept 17: JTG: Ch 4, pgs 84–99, start chapter, end at “Archimedes’ Masterpiece”

Sept 19: JTG: Ch 4, pgs 99–112, start at “Archimedes’ Masterpiece,” complete chapter

ASSIGNMENT DUE

Egyptian and Mesopotamian Mathematics

Sept 22: Crest: Ch 1

*** Course Project Proposal Due ***

QUIZ

Sept 24: Crest: Ch 3, pgs 79–100, start chapter, end at “Applications of Unit Fractions”

Sept 26: Crest: Ch 3, pgs 100–109, start at “Applications of Unit Fractions, end at “Egyptian Geometry”

Crest: Ch 3, pgs 119–122, subsection on “Egyptian Mathematics: A General Assessment”

ASSIGNMENT DUE

Sept 29: Crest: Ch 4, pgs 125–144, start chapter, end at “A Babylonian Masterpiece”

QUIZ

Oct 1: Crest: Ch 4, pgs 150–159, start at “Babylonian Algebra,” end at “Babylonian Geometry”

Oct 3: Crest: Ch 5

ASSIGNMENT DUE

A Glimpse of Chinese Mathematics

Oct 6: Crest: Ch 6, pgs 191–192, read Table 6.1

Crest: Ch 6, pgs 248–261, start at “The Piling Up of Rectangles,” end at “Estimation of π ”

QUIZ

Aspects of Mathematical Culture

Oct 8: LHM: Ch 1

Oct 10: LHM: Ch 2

Focus on Course Project

Oct 13: No reading

Oct 15: PEER EDIT DAY: First Version of Course Project Due

Islamic Mathematics

Oct 17: JTG: Ch 5, pgs 129–132, start in Epilogue after proof of Pythagorean Theorem, complete chapter

Crest: Ch 11, pgs 450–469, start chapter, end at “Mathematics in the Service of Islamic Law”

Oct 20: Crest: Ch 11, pgs 471-474, start at “The Theory of Numbers,” end at “Extraction of Roots”
QUIZ

Oct 22: Crest: Ch 11, pgs 475-487, start at “Extraction of Roots,” end at “Geometry in the Islamic World”

Oct 24: Crest: Ch 11, pgs 487-492, start at “Geometry in the Islamic World,” end at “Thabit ibn Qurra’s Generalization”

Crest: Ch 11, pgs 508-512, start at “The Islamic Contribution: Final Assessment,” complete chapter

ASSIGNMENT DUE

An Aside on Mathematics as an Addiction

Oct 27: LHM: Ch 4, pgs 106-131, start chapter, end at “André Bloch”

Re-read Course Syllabus

QUIZ

The Beginnings of Symbolic Algebra and Calculus

Oct 29: JTG: Ch 6, pgs 133-147, start chapter, end at “Further Topics on Solving Equations”

Oct 31: JTG: Ch 6, pgs 147-154, start at “Further Topics on Solving Equations,” complete chapter
ASSIGNMENT DUE

Nov 3: JTG: Ch 7, pgs 155-165, start chapter, end at “Newton’s Binomial Theorem”

QUIZ

Nov 5: JTG: Ch 7, pgs 165-174, start at “Newton’s Binomial Theorem,” end at “Great Theorem”

Nov 7: JTG: Ch 7, pgs 174-183, start at “Great Theorem,” complete chapter

Nov 10: JTG: Ch 8, pgs 184-196, start chapter, end at “Great Theorem”

QUIZ

Nov 12: JTG: Ch 8, pgs 196-206, start at “Great Theorem,” complete chapter

Leonard Euler, “Master of Us All”

Nov 14: JTG: Ch 9, pgs 207-212, start chapter, end at “Great Theorem”

Nov 17: JTG: Ch 9, pgs 212-222, start at “Great Theorem,” complete chapter

Nov 19: JTG: Ch 10, pgs 223-229, start chapter, end at “Great Theorem”

ASSIGNMENT DUE

Nov 21: JTG: Ch 10, pgs 229-244, start at “Great Theorem,” complete chapter

The Issues of Gender and Teaching

Nov 24: LHM: Ch 7, pgs 228-251, start chapter, end at “Aging Mathematicians”

ASSIGNMENT DUE

QUIZ

Nov 26 & 28: Thanksgiving Break

Dec 1: LHM: Ch 8

Completion of Course Projects

Dec 3: No Reading

Dec 5: Final Version of Course Project Due

The Nature of Infinity

Dec 8: JTG: Ch 11, pgs 245-258, start chapter, end at “Great Theorem”

QUIZ

Dec 10: JTG: Ch 11, pgs 259-266, start at “Great Theorem,” complete chapter

Dec 12: No Reading
ASSIGNMENT DUE

Final Course Discussion

Final: 9AM–10AM, Tuesday, 16 December, Final Course Discussion, Course Projects Returned
NOTE: The official start time for the final period is 8AM, but we will have our discussion from 9AM–10AM.

6. Assessment and Grading

There will be four elements to assessment and grading in this course: Participation, Homework Assignments, Quizzes, and a Course Project.

6.1. Participation and Attendance.

- You must be present and engaged in class each day.
- You are expected to participate on the course discussion board.
- Your participation grade will be largely subjective. If you have any concerns, come talk with me about them.
- *Absence Policy:*
 - You are allowed 3 unexcused absences. Beyond that, *you will lose 2% of your overall course grade for each unexcused absence.*
 - Students must notify the instructor of their absence prior to the absence or within one week after the absence.
 - Students must submit any written documentation supporting their excused absence within one week after the absence.
 - Absences for major religious holidays require one week advance written notification.

6.2. Homework Assignments.

- I will give assignments regularly. Some portions of the assignments must be typed.
- *WARNING:* No late work will be accepted.
- You should work with other students and share your ideas as part of our course community. However, you should not let your collaboration devolve into letting someone else do all the “hard parts” and then copying their answers.
- *Three Rules for Assignments:*
 - Don’t talk to anyone about the problems until you have made a genuine effort to solve them yourself.
 - You must write up the solutions on your own.
 - You may *not* search the internet for solutions to problems. We will use our creativity, course texts, and peer collaboration as our tools for investigating the history of mathematics.

6.3. Quizzes.

- Quizzes will take place roughly once per week, at the start of class.
- Quiz dates are listed on the course schedule.
- Each quiz will be ten minutes in length.

6.4. Course Project.

- You will choose a topic for and complete a major project related to the history of mathematics during the course of the semester. This will be a written project of length 15 pages (without cover sheet or references) with 1 inch margins, 12 point Times New Roman font, double spaced. The main requirement is that your project must involve a “great idea” of mathematics and provide a well-supported argument justifying this choice of topic. All projects are expected to be well-written, free from grammatical errors, and have excellent mathematical depth and style. A grading rubric will be provided early in the semester.
- You should direct a significant portion of your project toward a general university audience and articulate clearly which sections are aimed toward experts. *Journey Through Genius* is a good model for this type of exposition.
- You will turn in a first version of your project for peer review; the first version must be a complete project that you will revise substantially to create your final version.

6.5. **Course Grades.** Your course grade will be determined by your attendance, participation, assignments, quizzes, and project. The grading scale will be no stricter than the usual A>89.9, B>79.9, C>69.9, D>59.9, E otherwise, weighted as follows:

- Participation: 10%
- Assignments: 25%
- Quizzes: 25%
- Project:
 - First Version: 10%
 - Final Version: 30%

7. Course Expectations and Classroom/Learning Accommodations

All students are expected to follow the academic integrity standards as explained in the University Senate Rules, particularly Chapter 6, found at:

http://www.uky.edu/Faculty/Senate/rules_regulations/index.htm

Turn off all cell phones, pagers, etc. prior to entering the classroom. ***You are not to use your cell phones, pagers, or other electronic communication devices during class.*** An attitude of respect for and civility towards other students in the class and the instructor is expected at all times.

Any student with a disability who is taking this course and needs classroom or exam accommodations should contact the Disability Resource Center, 257-2754, room 2 Alumni Gym, jkarnes@uky.edu.

8. Graduation Writing Requirement Information

Learning Outcomes. This is a writing-intensive (W) course approved to fulfill the upper tier of the graduation writing requirement (GWR).

- Write a paper that is essentially free of mechanical errors (grammar, punctuation, spelling, and syntax) and awkwardness, using a style that is appropriate to the purpose and audience.
- Demonstrate an ability to discover, evaluate, and clearly present evidence in support of an argument in the subject area and utilize documentation that conforms to the formats and the citation conventions of the subject area.

- Be aware that composing a successful text frequently takes multiple drafts, with varying degrees of focus on generating, revising, editing, and proofreading.
- Write a capable, interesting essay about a complex issue (discipline-specific) for a general university audience.

Minimum Writing Requirements.

- Students will be required to write a minimum of 15 pages of formal writing.
- At least 10 of these pages must be single-authored assignments.
- No assignments requiring fewer than 4 pages may be included in the 15-page minimum.
- These 15 pages must go through a draft, review, and revision process. Peer review is sufficient to meet the review requirement.

Grading Policies. To pass the course, students must earn a grade of C or higher on ALL FORMAL assignments. Instructors can consider additional formal writing, writing other than the formal writing, or additional projects and assignments in the final grade computation. Thus, students can receive lower than a C as a final grade and still receive GWR credit. Any major assignment that receives a D or below must be revised to reflect competency and resubmitted. Instructors may limit the number of revision attempts and set time restrictions on revisions. At the discretion of the instructor, students who fail to achieve competency may receive an I (incomplete) grade, but in no case may a student whose writing fails to reach the level of C (competent) receive a passing grade in a course that satisfies the University Writing Requirement.

Plagiarism. Part II of Student Rights and Responsibilities (6.3.1; online at <http://www.uky.edu/StudentAffairs/Code/part2.html>) states that all academic work written or otherwise submitted by students to their instructors or other academic supervisors is expected to be the result of their own thought research or self-expression. In cases where students feel unsure about a question of plagiarism involving their work they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own but which in any way borrows ideas organization wording or anything else from another source without appropriate acknowledgment of the fact the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work whether it be published article chapter of a book a paper from a friend or some file or whatever. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor but when the actual work is done it must be done by the student and the student alone.

When a student's assignment involves research in outside sources or information the student must carefully acknowledge exactly what where and how he/she has employed them. If the words of someone else are used the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Plagiarism also includes making simple changes while leaving the organization content and phraseology intact. However nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain.