

Mathematics 3820H – Mathematics from medieval to modern times

TRENT UNIVERSITY, Fall 2016

[In Peterborough!]

Instructor

Stefan Bilaniuk (pronounced Стефан Біланюк)

office: GCS 337

Fall hours: Weekdays (except Wednesdays) 10:00-10:50,

or by appointment, or just drop by!

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Department of Mathematics

office: GCS 346

hours: weekdays 09:00-16:30

phone: 705 748-1011 x7531

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Prerequisites

Prerequisite: Mathematics 1100Y or 1101Y, with $\geq 60\%$, or permission of the instructor.

Recommended: Mathematics 2200H or Mathematics 2350H.

Text

A Short Account of the History of Mathematics (4th Edition), by W. W. Rouse Ball, 1908.

A version (in pdf and in T_EX) is available online (for free!) from Project Gutenberg at:

<http://www.gutenberg.org/etext/31246>

Additional readings will be assigned from other sources distributed in class or available online. Please see the handout *Readings & Schedule* for a tentative week-by-week schedule.

Meetings

Lectures: Tuesday 12:00-12:50 in GCS 111, and Thursday and Friday 11:00-11:50 in GCS 108.

Seminars: Tuesday 13:00-13:50 in GCS 110.

Marking Scheme

There will be at least six assignments, a project (which may be a solo or group project), and a take-home final examination. The final mark will be calculated as follows:

| | |
|---------------------------------|-----|
| Best 5 assignments (5 @ 7% ea.) | 35% |
| Project proposal | 4% |
| Project | 30% |
| Final examination | 31% |

Assignments will not normally be accepted after the due date. Students who cannot submit work on time for reasons beyond their control should contact the instructor as soon as possible. Note that work worth at least 25% of the course will be marked and returned by the final date (Tuesday, 8 November) to withdraw from Fall term half-courses without academic penalty.

This scheme may be modified for students in *exceptional* circumstances. Any such modification will require the agreement of both the student and the instructor.

Learning Outcomes

MATH 3820H is a survey of the development of mathematics in India, the Middle East, and Europe from medieval times to the modern era, with particular attention to the development and spread of the Hindu-Arabic number system, algebra, and the eventual

development of calculus. Students will be exposed to the problem of interpreting the available data (*e.g.* the priority dispute concerning the invention of calculus), and will read portions of several original sources in translation. In rough chronological order, we will consider the development of mathematics in:

1. Ancient and medieval India
2. The medieval Islamic world
3. Medieval, Renaissance, and modern Europe

Academic Integrity

Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from a 0 grade on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's Academic Integrity Policy. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more – www.trentu.ca/academicintegrity

For clarity, the following guidelines will apply in MATH 3820H:

You are permitted and encouraged to work together and ask anyone willing (especially the instructor!) for explanations, hints, and suggestions on the assignments and projects, and to consult whatever sources you wish, with the exception that **you may not consult anyone who has taken a similar course recently or their work**. However, **all work submitted for credit must be written up entirely by you** (with the exception of group projects), **giving due credit to all relevant sources of help and information**. The restrictions for the take-home final exam will be spelled out on the exam. Except as noted on particular assignment questions, and with the restrictions noted above, you may use whatever aids you wish.

Access to Instruction

It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Student Accessibility Services Office (SAS), Blackburn Hall Suite 132, 705 748-1281, accessibilityservices@trentu.ca. For Trent University in Oshawa Student Accessibility Services Office contact 905 435-5102, ext. 5024. Complete text can be found under Access to Instruction in the Academic Calendar.

Web Page

This course will make no use of Blackboard/LearningSystem. Information about the course and all handouts to date will be posted to: euclid.trentu.ca/math/sb/3820H/

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Readings & Schedule

The schedule below is firm, barring unforeseen events and necessities, for due dates and such, but it is a polite fiction so far as progress through the content of the course is concerned – no lesson plan survives contact with students! – and our actual pace, and perhaps the additional readings, will be adjusted as necessary. The skeleton of our readings is from the text:

A Short Account of the History of Mathematics (4th Edition), by Walter W. Rouse Ball, 1908.

It is available online (pdf and \TeX) from Project Gutenberg at:

<http://www.gutenberg.org/etext/31246>

The text is somewhat dated in style and content, and is, in any event, intended as a relatively sparse outline. The skeleton it provides will be fleshed out in the lectures and with readings from various sources, original and otherwise, available on line. Please note that the readings and additional sources given below are potentially subject to change.

Week 0. (8–9 September) Organizational lecture. History and historiography. *Classes begin on Thursday, 8 September.*

Week 1. (12–16 September) Please read pp. 120-129 in Chapter IX of the text and pp. 1-8 & 21-50 of the *Āryabhaṭīya*, by Āryabhaṭa, trans. by W.E. Clark, Univ. of Chicago Press, Chicago, 1930. It can be found (pdf) online at:

<http://www.wilbourhall.org/pdfs/aryabhatiyaEnglish.pdf>

Week 2. (19–23 September) Please read pp. 129-135 in Chapter IX and pp. 136-137 in Chapter X of the text, and pp. 1-21 of *The Algebra of Mohammed ben Musa* [*i.e.* al-Kwarizmi], ed. and trans. by Frederic Rosen (London, 1831), which can be found (pdf) online at:

http://www.wilbourhall.org/pdfs/The_Algebra_of_Mohammed_Ben_Musa2.pdf

- Assignment #1 due on Friday, 23 September.

Week 3. (26–30 September) Please read pp. 109-119 in Chapter VIII and pp. 138-164 in Chapters X-XI of the text.

Week 4. (3–7 October) Please read pp. 165-189 in Chapter XII of the text and pp. 207–276 of *Jerome Cardan: The life of Girolamo Cardano, of Milan, physician*, Vol. I, by Henry Morley (London, 1854), which can be found (pdf and epub) online at:

<http://books.google.ca/books?id=lskVAAAAAYAAJ>

- Assignment #2 due on Friday, 7 October.

Week 5. (10–14 October.) Please read pp. 189-201 in Chapter XII of the text and all of the *History of the Invention of Logarithms*, an appendix (pp. 435-507) in *Memoirs of John Napier of Merchiston*, by Mark Napier (London, 1834), which can be found (pdf and epub) online at:

<http://books.google.ca/books?id=husGAAAAAYAAJ>

[Chapters IX-X (pp. 328-434) of this book give a more detailed account of Napier's part in the invention of logarithms, and may be worth a look too.]

- Project proposal due on Friday, 14 October. *No classes on Thanksgiving Day, Monday, 10 October.*

Week 6. (17–21 October.) Please read pp. 202-210 in Chapter XIII of the text and pp. 153-187 of *Dialogues Concerning Two New Sciences*, by Galileo Galilei, trans. by H. Crew & A. de Salvio (MacMillan, New York, 1914), which can be found (pdf, epub, & other formats) online at:

<http://openlibrary.org/works/OL15231447W>

- Assignment #3 due on Friday, 19 October.

Week R. *Reading Week! (24–28 October)* Enjoy reading something else – or work on your project!

Week 7. *(31 October – 4 November)* Please read pp. 210-237 in Chapters XIII-XV of the text and all of the *Essay on Conics*, by Blaise Pascal, trans. by F.M. Clarke. This can be found in *A source book in mathematics*, Volume 1, by David Eugene Smith (Dover Publications, 1984, ISBN 0486646904); the relevant part can be found online (though not for download) at:

http://books.google.ca/books?id=awAf07Ff_z0C&pg=PA326

Week 8. *(7–11 November)* Please read pp. 237-290 in Chapters XV-XVI of the text.

- Assignment #4 due on Friday, 11 November. *The last date to drop Fall term half-courses without academic penalty is Tuesday, 8 November.*

Week 9. *(14–18 November)* Please read pp. 291-301 in Chapter XVII of the text and *An Account of the Book Entituled Commercium Epistolicum Collinii et Alliorum, de Aanalysisi Promota*, by Isaac Newton [writing anonymously], *Philosophical Transaction of the Royal Society of London*, No. 342, January and February 1714, pp. 173-224. This is reprinted on pp. 116-153 of *The Philosophical Transactions of the Royal Society of London, from their commencement, in 1665, to the year 1800; Abridged*, Vol. VI (London, 1809), which can be found online (pdf and epub) at:

<http://books.google.ca/books?id=t0JKAAAAAYAAJ&pg=PA116>

An edition prepared by D.R. Wilkins can be found online (pdf) at:

<http://www.maths.tcd.ie/pub/HistMath/People/Newton/CommerciumAccount/>

Week 10. *(21–25 November)* Please read pp. 301-321 in Chapter XVII of the text and pp. 51-68 of *A Treatise of Fluxions*, Vol. I, by Colin MacLaurin (Edinburgh, 1742), which can be found online (pdf and epub) at:

<http://books.google.ca/books?id=dCA0AAAAQAAJ>

This book was MacLaurin's attempt to make the foundations of calculus rigorous in response to George Berkeley's criticisms, for which check out, if you wish, *The Analyst* [2nd edition] (London, 1754). It can be found online (pdf) at:

<http://books.google.ca/books?id=TqCZhiQdXogC>

- Assignment #5 due on Friday, 25 November. The take-home final examination will be distributed on Thursday, 24 November.

Week 11. *(28 November – 2 December)* Please read pp. 322-364 in Chapter XVIII of the text and pp. 54-70 & 144-157 of *Elements of Algebra* (2nd Edition), Vol. I, by Leonard Euler (trans. by ?, London, 1810), which can be found online (pdf) at:

<http://books.google.ca/books?id=hqI-AAAAAYAAJ>

Week 12. *(5–7 December)* Please read pp. 365-401 in Chapter XIX of the text.

- Assignment #6 due on Wednesday, 7 December, 2014. *The last day of classes is on Wednesday, 7 December.*

Mid-term test and Fall half-course final examination period. *(9–21 December)*

- Project and take-home final examination due on Friday, 16 December.

Departmental Policy: *The final date to appeal marks for assignments, quizzes, or projects for Fall half-courses is Monday, 6 March, 2017.*

Last modified 2016.09.02.