BO1.1. History of Mathematics
Lecture I
Introduction

MT24 Week 1

Contact details

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Summary

- The nature of history
- How can we organise/break down the history of mathematics?
- Rough overview of the course
- Arrangements: lectures, classes, the nature of the course
- Some advice on reading and taking notes

What is history (of mathematics)?

History, particularly the history of mathematics, is often written in a very ‘narrative’ way, as a sequence of events with dates, detailing the achievements of major figures, telling a linear story of how we got to where we are today

Although this approach can be useful as a first approximation to the real story, there are several things wrong with it ...

... history is much more than a catalogue of events

What is history (of mathematics)?

When we study history, we may start by addressing the what, the when, and the who, but we are also interested in the how, and, perhaps most importantly, the why

The major figures in the history of mathematics are not the only people to have contributed to mathematics, so we might need to expand our notion of what counts as ‘mathematics’

The story of mathematics is not linear: there are false starts and dead-ends, twists and turns, parallel developments; it is not a story of relentless progress: there are fallow periods and mistakes — but these too have shaped mathematics in their own ways

Augustus De Morgan on the history of mathematics (1865)

It is astonishing how strangely mathematicians talk of the Mathematics, because they do not know the history of their subject. By asserting what they conceive to be facts they distort its history . . . There is in the idea of every one some particular sequence of propositions, which he has in his own mind, and he imagines that that sequence exists in history . . .

Usually not the case!

Warning!

All this being said ...

Within the constraints imposed by this course (not least the need to fit it into 16 lectures), it will be all too easy to slip into a linear narrative of significant results

But this is not a disaster, provided we remain aware that it is happening. The lectures will provide much of the who, what, where, when; the classes will be where we can discuss the broader implications and historical questions. What can we learn from these mini historical episodes?

How do we organise the history of mathematics?

- periods (ancient, mediaeval, *n*th century, ...)
- places/cultures (Greece, Islam, Britain, ...)
- people (Archimedes, Newton, Euler, Hilbert, Noether, ...)
- topics (geometry, algebra, topology, probability, ...)
- sources (manuscripts, letters, books, journals, websites, ...)
- institutions (Royal Society, universities, LMS, ...)
- conferences (international congresses, local seminars, ...)

An outline of the course

Week 1: Introductory material: mathematics up to 1600

Week 2: Analytic geometry and the origins of calculus

Week 3: Newton's *Principia*; the further development of calculus

Week 4: Infinite series; the beginnings of rigour

Week 5: Algebra: from classical to modern

Week 6: Rigour in real analysis

Week 7: Complex analysis; linear algebra

Week 8: Geometry; number theory; historiography

Organisation by period

This course deals with (largely European) mathematics during the period 1600–1900

At different points of the course, we will consider particular places, people, and topics.

But if we were to divide up the course by century, we might see the following:

Organisation by period: 17th century

Topics:

- new notation
- analytic (co-ordinate) geometry
- calculus
- infinite series
- mathematics applied to the physical world

People: Descartes, Fermat, Wallis, Newton, Leibniz, Huygens, l'Hôpital, ...

Organisation by period: 18th century

Topics:

- many applications of (and some problems with) calculus
- applications (and problems) of infinite series
- developments in algebra and number theory
- mathematics applied to the physical world

People: Bernoullis, Euler, d'Alembert, de Moivre, Laplace, Lagrange, ...

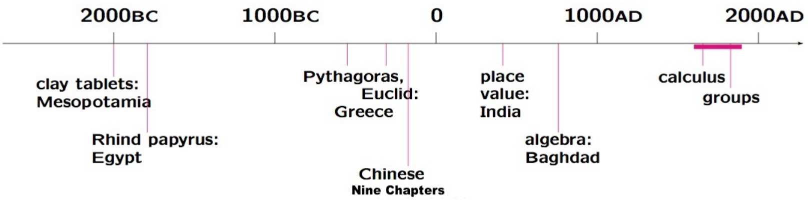
Organisation by period: 19th century

Topics:

- from calculus to analysis
- development of complex analysis
- rise of abstract algebra
- beginnings of linear algebra
- non-Euclidean geometry
- beginnings of axiomatisation

People: Gauss, Fourier, Bolzano, Cauchy, Abel, Galois, Dirichlet, Cayley, Dedekind, Cantor, ...

A timeline



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Baghdad
calculus
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But what about non-Western mathematics?

Much of the world's present-day underlying mathematical culture — the way of doing it (e.g., notation, structure of arguments), of publishing it, and so on — is of European origin, and it is worth bearing in mind why.

The export of European mathematics to the rest of the world has been going on for centuries — for example, at the end of the 16th century, Jesuit missionaries began to introduce European mathematics into China, where it soon supplanted local mathematical traditions.

In the period 1600–1900, most of the parts of the world that had a culture of mathematics that went beyond arithmetic were doing mathematics in a European style — a legacy of imperialism and colonialism.

As we go through the course, please keep in mind that the way in which we do mathematics now is neither the only way to do it nor necessarily the 'best' way, and that what is 'best' might differ depending on the context.

Wasan

An example of a mathematical tradition that was significantly different from the European one was wasan 和算 (Japanese mathematics) which flourished during the Edo Period (1603–1867)

See Tsukane OGAWA, 'A review of the history of Japanese mathematics', *Revue d'histoire des mathématiques* **7** (2001) 137–155

and also Japanese Mathematics in the Edo Period

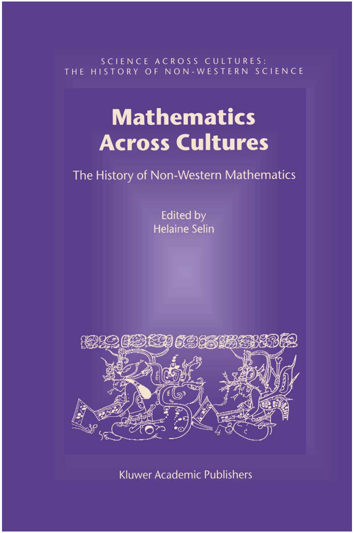
Other non-European mathematics

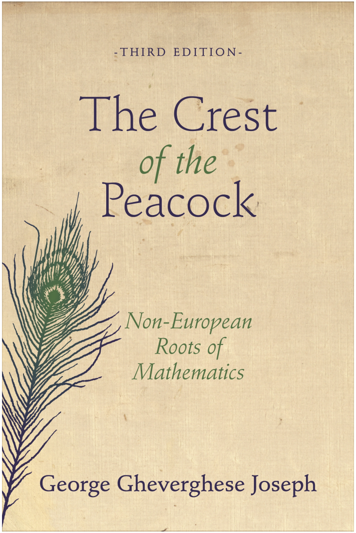
In this course, we will see other instances of non-European mathematics that are important for our story; for example:

- solution of systems of linear equations in the *Jiǔzhāng Suànshù* (2nd century BC, China) [week 7]
- solution of polynomial equations by al-Khwārizmī (9th century Baghdad) [week 5]
- study of infinite series by the 'Kerala School' (14th–16th-century India) [week 4]

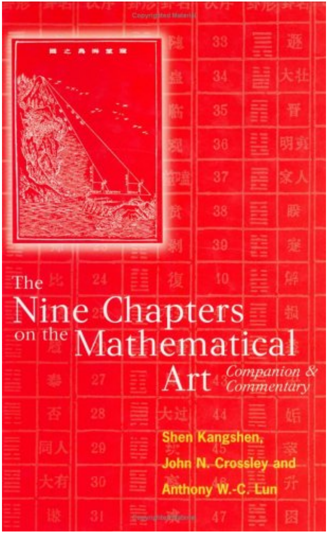
But we will not be systematic in our treatment of non-European mathematics

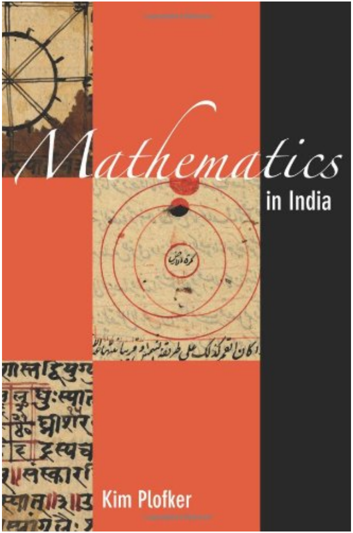
On non-European mathematics



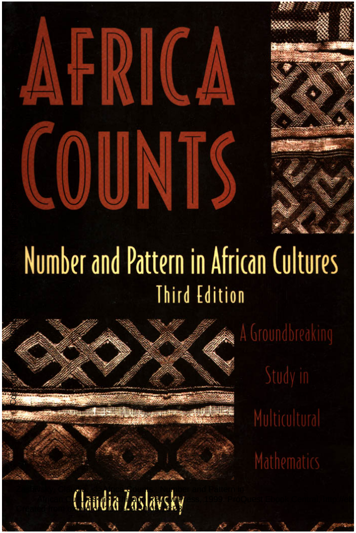


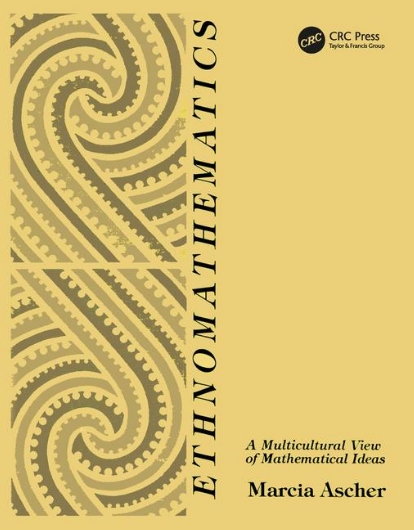
On non-European mathematics





On non-European mathematics





Administrative matters, MT

- Lectures: Wednesdays, 14:00–16:00, with a break in the middle, L6 (lecture slides to be posted online week by week)

- Classes: to be held on Fridays in weeks 3, 5, 6, 7, 9:00–10:30 and 10:30–12:00, in C1

- Work: 1,000-word essay and preparation of a discussion topic for each class — essays to be submitted via the course webpage by 12:00 on the Mondays of weeks 3, 5, 6, 7

- Sheets: details of weekly reading, and of essay and discussion topics, can be found on course webpage

- Assessment: written paper in TT25

Administrative matters, HT

Topic: The introduction of differential notation (and therefore Leibnizian calculus) into Britain

- A reading course with ‘seminars’ in weeks 1–8
- In-depth study of original works by relevant authors, including Robert Woodhouse, Mary Somerville, and others
- Two or three essays of 2,000 words each, and preparation of a discussion topic for each class
- Assessment: 3,000-word essay, topic revealed in week 7, to be submitted by 12 noon on Monday, week 10

Advice on taking notes and writing essays

- See the notes on the course webpage
- Pay particular attention to the sections on
  - citing sources,
  - bibliographies, and
  - plagiarism
- The importance of clear and accurate citations will be stressed throughout the course — these serve the same purpose as proofs in mathematical arguments

Taking notes

From reading:

- *background* reading is for information, not examination: it is important, but don't spend too long on it
- read the material (at least) twice
  - on the first reading, try to get a general feel for the material, its meaning and significance
  - on the second, take notes (see the online guidance)

From lectures:

- Don't try to take down every detail
- Instead, read ahead, listen, think, ask questions

The lectures and the reading will cover some of the same ground but are designed to be complementary

Recommended reading: the main texts

Jacqueline Stedall, *Mathematics emerging: a sourcebook 1540–1900*, Oxford University Press, 2008 [available in print and electronically]

and

Victor Katz, *A history of mathematics: an introduction*, Pearson New International edition, Pearson, 2014 [available in print and electronically]

(College libraries may have earlier editions of the latter, and these can also be used.)

Recommended reading: other useful books

Jacqueline Stedall, *The history of mathematics: a very short introduction*, Oxford University Press, 2012 [available in print and electronically]

Benjamin Wardhaugh, *How to read historical mathematics*, Princeton University Press, 2010 [available in print and electronically]

John Fauvel and Jeremy Gray, *The history of mathematics: a reader*, Macmillan/Open University, 1987 [only available in print]

June Barrow-Green, Jeremy Gray and Robin Wilson, *The history of mathematics: a source-based approach*, vol. 1, MAA Press, 2019; vol. 2, 2022 [both volumes available in print but only volume 1 electronically]

Further books (usually on specific topics) will be cited throughout the course

Recommended reading: other useful resources

Some biographical resources:

(Complete) Dictionary of Scientific Biography (*DSB*): available via SOLO

Oxford Dictionary of National Biography (*ODNB*): available via SOLO

There are many other general histories of mathematics available — you are encouraged to read widely, but please read critically