BO1 History of Mathematics
MT 2019

Preliminaries

Standard texts for the course:

Jacqueline Stedall, *Mathematics emerging: a sourcebook 1540–1900*, Oxford University Press, 2008

and *either*

Victor Katz, *The history of mathematics: brief version*, Pearson, 2003

or

Victor Katz, *A history of mathematics: an introduction*, 3rd ed., Addison-Wesley, 2009

(College libraries may have earlier editions of the latter, but these do not differ significantly in content as far as this course is concerned.)

Other books that might be useful:

Jacqueline Stedall, *The history of mathematics: a very short introduction*, Oxford University Press, 2012

Benjamin Wardhaugh, *How to read historical mathematics*, Princeton University Press, 2010

John Fauvel and Jeremy Gray, *The history of mathematics: a reader*, Macmillan/Open University, 1987

June Barrow-Green, Jeremy Gray and Robin Wilson, *The history of mathematics: a source-based approach*, vol. 1, MAA Press, 2019

Preliminary background reading (weeks 1–3):

	Stedall	Chapters 1, 2
and *either*	Katz (brief)	Chapters 1–4, 7, 8
or	Katz (1st/2nd ed.)	Chapters 1–5, 7, 8
or	Katz (3rd ed.)	Chapters 1–6, 9, 10

(On the origins of mathematics, ancient Greek mathematics, and the mathematics of mediaeval Europe and the Islamic world.)

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Sheet 1

Reading for weeks 1–3:

	Stedall	Chapters 3, 5, 9, 10
and *either*	Katz (brief)	Sections 9.3, 9.4, 10.2, Chapter 11
or	Katz (1st/2nd ed.)	Chapters 10 and 12, Section 11.1
or	Katz (3rd ed.)	Chapters 13, 15, 16, Section 14.2

(On analytic geometry, mathematics and the physical world, the origins of the calculus, Newton's *Principia*, the initial applications of calculus, and the emerging notion of a 'function'.)

Essay to be submitted at the start of the lecture on Monday week 3:

It has sometimes been claimed that Fermat should be considered as one of the founders of the calculus. More recently, Katz has attributed the Fundamental Theorem of Calculus to Gregory and Barrow. What arguments can be given for or against such claims? What does it mean to say that Newton or Leibniz 'discovered' the calculus? Does being 'first' matter? (1,000 words)

Discussion topic to be prepared for class in week 3:

Read the extract in *Mathematics emerging*, §3.2.1 (Fermat's evaluation of an 'infinite' area) and be prepared to discuss it in class under the following headings.

(i) Context: when, where, and for whom was the piece written? What mathematical background does it assume?

(ii) Content: work through the content as carefully as you can, noting the parts that are particularly difficult or tricky. Is Fermat's argument convincing?

(iii) Significance: how important was this piece of work in the 17th-century development of methods of quadrature?

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Sheet 2

Reading for weeks 4 and 5:

	Stedall	Chapters 8, 11, 12, 13
and *either*	Katz (brief)	Sections 9.1, 10.1, 14.2, Chapter 12
or	Katz (1st/2nd ed.)	Sections 11.2, 14.2, 14.4, Chapter 13
or	Katz (3rd ed.)	Sections 14.1, 19.1, 19.2, Chapter 17

(On power series, limits and continuity, 18th century analysis, the theory of equations, and the origins of abstract algebra.)

Essay to be submitted at the start of the lecture on Monday week 5:

Read the derivation of d'Alembert's wave equation (1747) (*Mathematics emerging*, §10.1.2). Explain its context, point out the most important aspects of its content, and assess its significance. (1,000 words)

Discussion topic to be prepared for class in week 5:

In discussing Isaac Newton and his work, we touched upon the idea of 'mathematical myth-making': the telling of (possibly apochryphal) stories about our mathematical heroes and their supposed flashes of genius, etc. Can you think of any other examples of exaggerated stories about mathematicians? Should we simply condemn these stories as inaccurate, or do they have a role to play within mathematical culture?

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Sheet 3

Reading for week 6:

	Stedall	Chapters 14, 15, 16, 18
and *either*	Katz (brief)	Sections 16.1–16.3, 17.1–17.3
or	Katz (1st/2nd ed.)	Sections 15.1–15.4, 16.1–16.3
or	Katz (3rd ed.)	Sections 21.1–21.3, 22.1–22.3

(On derivatives and integrals, real and complex analysis, mathematical rigour, number theory, symbolic algebra, and the foundations of mathematics.)

Essay to be submitted at the start of the lecture on Monday week 6:

Read the extract from Cayley's first paper on group theory (1854) (***Mathematics emerging***, §13.1.4). Explain its context, point out the most important aspects of its content, and assess its significance. (1,000 words)

Discussion topics to be prepared for class in week 6:

(1) After submitting your essay, you will be provided with a further short extract from Cayley's paper. Please read this and consider how different your essay would have been (if at all) if you had read this further extract first.

(2) Look at the attempts made by Landen (1758), Lagrange (1797), and Ampère (1806) to define derivatives. Be prepared to discuss one of the methods in detail, and explain how far (or not) it was successful.

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Sheet 4

Reading for weeks 7 and 8:

	Stedall	Chapters 6, 17
and *either*	Katz (brief)	Sections 10.4, 14.1, 16.4, 19.1,* 20.1
or	Katz (1st/2nd ed.)	Sections 11.4, 15.5, 16.4, 17.2*
or	Katz (3rd ed.)	Sections 14.4, 21.4, 22.4, 24.2*

(On matrices, linear equations, and vector spaces, number theory, and non-Euclidean geometry.)

*Principally the material on Bolyai, Lobachevsky, and their work.

Essay to be submitted at the start of the lecture on Monday week 7:

Read the extract from Cauchy's 1826 paper on the calculus of residues (*Mathematics emerging*, §15.2.3). Explain its context, point out the most important aspects of its content, and assess its significance. (1,000 words)

Discussion topic to be prepared for class in week 7:

What is algebra? We have seen the subject go through several incarnations, but is there a common thread that runs throughout? If so, what is it? If not, how can we justify the use of the same name for different subjects?

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Supplementary Sheet

In lecture 16, we will have the opportunity for a final discussion which will serve to round off the course. As preparation for this discussion please reflect on your experience of the course, and perhaps revisit the material in the first lecture concerning the nature of the study of the history of mathematics, and think about how you would answer the following questions:

- What is the history of mathematics?
- What does it mean to study the history of mathematics?
- How have your views changed (if at all) since the beginning of the course?

To take things further, recall how we have seen that many of the people who have done mathematics in the past were pursuing it as a side-interest in addition to their usual (non-mathematical) work. We might therefore question what the word 'mathematician' actually means in any given historical context.

- What do you think the word has meant in this course?
- Has it had the same meaning throughout?

Indeed, we might ask the same questions about 'mathematics':

- What has the word 'mathematics' meant throughout the course?
- Has it had the same meaning throughout?
- More generally, has it had the same meaning throughout history?

Finally, we will reflect on the extent to which we choose what we mean by 'mathematics':

- If we choose to understand the word 'mathematics' differently, how does this change our view of the history of mathematics?
- How could a revised definition of 'mathematics' change the selection of people and cultures who appear in the story?
- What does the study of the history of mathematics have to tell us about the way in which we approach mathematics nowadays?