O1 History of Mathematics
MT 2018

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

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 by email (to christopher.hollings@maths.ox.ac.uk as pdf) by 12 noon 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? (1000 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 by email (to christopher.hollings@maths.ox.ac.uk as pdf) by 12 noon 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. (1000 words)

Discussion topic to be prepared for class in week 5:

We have seen that in the early seventeenth century, most of the people who were doing mathematics were pursuing it as a side-interest in addition to their usual (non-mathematical) work. By the end of the seventeenth century, however, and certainly into the eighteenth, we begin to see more people being employed specifically to carry out mathematical investigations, perhaps in universities or in academies. What effect did this change have on the development of mathematics? Does it have any bearing on what we mean by the word 'mathematician'?

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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 by email (to christopher.hollings@maths.ox.ac.uk as pdf) by 12 noon 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. (1000 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 by email (to christopher.hollings@maths.ox.ac.uk as pdf) by 12 noon 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. (1000 words)

Discussion topic to be prepared for class in week 7:

Compare the attempts of Dedekind and Cantor to define the completeness of the real numbers. What were their motivations? How were numbers and their operations technically defined in each case?