History of early modern mathematics, 1200-1700
(Medieval, Renaissance, and Scientific Revolution)

Start date	13 November 2020	**End date**	19 November 2020

Venue	Virtual Classroom

Tutor	Piers Bursill-Hall	**Course code**	2021NDR428

Director of Academic Centres		Dr Corinne Boz

For further information on this course, please contact the Lifelong Learning team	Zara Kuckelhaus shortcourses@ice.cam.ac.uk

To book	See: www.ice.cam.ac.uk or telephone 01223 746262

Tutor biography

Piers Bursill-Hall was educated in England, France, USA, and Canada; university studies in mathematics and foundations of quantum mechanics (quantum logic) at Cambridge. Subsequently he has had a career in history of mathematics, and history of science, teaching at Cambridge in the Faculty of Mathematics and the Institute of Continuing Education, and elsewhere in Europe and North America, South Korea, India and Bangladesh. His research has concentrated on ancient mathematics (origins of proof; mathematical astronomy), Renaissance mathematical arts and sciences (changing status of mathematics, maths and engineering), and Enlightenment mathematics (foundations and dissemination of higher mathematics in France). Recently he has developed a side interest in early Islam and the origins of Islamic interest in science. He has taught very widely on the last two or three thousand years of history of science, history of mathematics and history of medicine for the Institute for Continuing Education.

Course programme

These interactive online sessions will start at 6.30pm each day for 7 days beginning on Friday 13 November. Each session will last approximately one hour (with additional time for questions and discussion) and all sessions will be recorded and made available to students shortly after the course has finished. The lectures will be online using a secure version of Zoom, and you will get an email before the lecture with the meeting invitation, URL, and password. If you are new to Zoom, there will be a separate guide for how to set it up.

Friday 6.30pm

Session 1:   Medieval Muslim inheritance, new tech and ancient wisdom, universities, logic and symbols, and Leonardo (no, not that one) and capitalism.

Saturday 6.30pm

Session 2:   Renaissance maths, status of the Greeks, and the power of mathematics; Brunelleschi, engineers, and mathematics as a window on the mind of God

Sunday 6.30pm

Session 3:   Geometry, recovery of Archimedes, ambitious engineers, the diversity of mathematical practices

Monday 6.30pm

Session 4:   Where did algebra *really* come from? It is *not* the Arabs; instead it is cubics, printing books, printed notation, and equations

Tuesday 6.30pm

Session 5:   Going beyond the ancients (i): infinitesimals, the missing heuristic, and maths goes rogue

Wednesday 6.30pm

Session 6:   Going beyond the ancients (ii): Cartesian algebraic geometry, a hidden heuristic? The search for a Theory of Everything (the GAGTOC)

Thursday 6.30pm

Session 7:   New maths, new physics, new cosmology, new science, new world. It's called force, and here are its equations.

Course syllabus
Aims:
To understand the radical changes and developments that occurred in mathematics in the Renaissance as well as in the decades leading up to the discovery of the calculus (which – at the time – is just a new theory of curves) by Newton and Leibniz, and to see how changing ideas in mathematics had profound effects on how we view the world. This also involves seeing how developments in the arithmetical art of problem solving – soon, algebra – and the development of the science of equations – also algebra – as well as the enterprise of trying to go beyond the ancient Greek mathematical theory of curves all conspired, slowly, to completely change the authority of mathematics and how mathematics was used to describe and explain the world. The revolution in the ambitions of science in the 18th century were, ultimately, dependent on the ambitions of mathematics to explain just about everything.

Content:
This is the second of two separate, stand-alone courses on the history of maths from the ancients to the scientific revolution; this course will mostly look at the Renaissance and Scientific Revolution, and how a number of unconnected events, discoveries, or styles of mathematical thinking emerged from very different (even random) circumstances. The real point is to see how things we think of as 'modern' really weren't all that 'modern' to actors at the time, and what we see as getting the right idea, or making progress, were just not viewed like that at the time. Instead, these past developments will be explained in terms of the day, rather than seen as progress towards what we now think. Furthermore these lectures will get you to see behind the technical mathematics to see mathematics in its social, intellectual, philosophical, cultural context … and the ultimate goal is to enable you to get a feeling you understand what went on in mathematics and why it was so important, but without having to master the technicalities. So the course is narrative, and not about technicalities; no maths problems to solve, no homework to hand in. A good sense of humour will help, but no particular background in the history or in mathematics is required, just a basic curiosity about odd corners of the past.

Presentation of the course:
The course will be live lectures on Zoom (like the rest of our lock-down lives), and will consist of lectures – without Power Point – and ample time at the start and the end of each lecture for discussion and questions. The course is non-technical (so no theorems on the blackboard, no formulae to memorise, no problems to do, no homework to hand in), and is *not* about teaching you how to *do* mathematics but coming to an understanding of the role of mathematical ideas and ambitions in earlier scientific thinking. There will be time at the end of each lecture session for discussion and questions.

As a result of the course, within the constraints of the time available, students should be able to:
1. Understand the errors of 'Whig historiography' and how to think about past science without seeing it as just the precursor to modern science;
2. See both the middle ages and the Renaissance as scientifically rich and very, very interesting (way more than you probably thought), and full of incredibly important and radical innovations in maths and mathematical sciences;
3. Understand a bit more about the importance of the scientific revolution and what actually changed (and didn't change) in the 17th century, and some of the reasons these changes came about;

4. Open your eyes (if they need opening!) to the idea that the historical role of mathematics can be understood without having to *do* the mathematics, and that mathematics has a fascinating, exciting (yes, really) past that shows how deeply involved maths is in our long-term cultural, intellectual history. And all without having to sweat away at individual theorems.

Reading and resources list

Listed below are texts that might be of interest should you wish to supplement your learning on the course. Some can be found 2nd hand.

Please note:
There is no single work or monograph that will give you a reasonably approachable history of maths over this half millennium. Seriously – there is almost nothing that is both tolerably up to date and approachable, and affordable on this subject. There is lots of very (*very*) heavy scholarly literature, but something that you might want to read to start off with? Don't hold your breath. There are very technical and dry introductions to history of maths that just doesn't put it into historical or human context, and there are books that have been recently published, and are at least a century out of date. Leafing through Amazon I see books reprinted that were written before WWI or WWII (and no indication they are a century old), or recent texts that are histories-designed-to-teach-you-some-maths, which is exactly and precisely what this course is not. Avoid books by Stillwell (historically inaccurate), Gullberg (out of date), Hodgkin (simplistic and dated), Struik (out of date), Katz (dated), D.E. Smith (way out of date), Levy, Pickover (old-fashioned & naïve), Ball (naïve), Bell (out of date) … and so it goes on. This doesn't leave a lot for you to read.

Author	Title	Publisher and date
Kline, M.K.	*Mathematical Thought from Ancient to Modern Times vols 1 & 2*	Dates from the 1970s, parts of a 3 volume history of mathematics; is factually reasonably correct, but is a *technical* history of mathematics, without deeper discussion.
Kline, M.K.	*Mathematics and the Physical World*	Is very out of date (first published many decades ago) and missing a lot of scholarship, but does attempt to show how mathematics and physical sciences have been integrated in the past.
Boyer C.B.	*A history of mathematics*	Written about 70 or 80 years ago, completely out of date and supposedly brought up to date a few decades ago, and *still* hopelessly out of date. But at least it is a technical history that is slightly readable; I still wouldn't recommend it.

Lindberg, D.C. & Shank, M.H. eds	*Cambridge History of Science Vol. 2 Medieval Science*	Has assorted chapters on sciences, mathematical sciences, and maths in Muslim and European societies; this is one of the more reasonable introductory works; you can peruse more widely to taste. Expensive as a paperback, but an electronic copy will be available on the course Moodle page.
Park, K. & Daston, L. eds	*Cambridge History of Science Vol.3: early modern science*	Like the above, this has assorted chapters on sciences, mathematical sciences, and maths in the Renaissance and Scientific Revolution; this is one of the more reasonable introductory works; you can peruse more widely to taste. Expensive as a paperback, but an electronic copy will be available on the course Moodle page.
Steadall, J	*The history of mathematics (very short introductions)*	OUP 2012; short and inexpensive and within the extreme limitations of length, fairly good; up to date and competent and intended to be an easy read (but not childish).
Boas, M.B.	*The scientific renaissance 1450-1630*	Various reprints; very old but has a good chapter on mathematics and maths in the renaissance and early scientific revolution
Hall, A.R.	*The scientific revolution*	Varous reprints; very old but has a couple of reasonable chapters on maths and the new sciences of the 17th century. Hardly cutting edge, but its readable and sensible.
Wootton, D.	*The invention of science: a new history of the scientific revolution*	Allan Lane, 2015; not in the least *new*, but a completely traditional history without the slightest innovation. But it covers the mechanical and physical sciences and their dependence on mathematical innovations just a little, so might be worth a read if you're interested.

Additional information

Venue

Online using 'zoom'. A link to the course will be made available via email, and any queries should be emailed to shortcourses@ice.cam.ac.uk.

Note Students of the Institute of Continuing Education are entitled to 20% discount on books published by Cambridge University Press (CUP) which are purchased at the Press bookshop, 1 Trinity Street, Cambridge (Mon-Sat 9am – 5:30pm, Sun 11am – 5pm). A letter or email confirming acceptance on to a current Institute course should be taken as evidence of enrolment.

Information correct as of: 11 November 2020