UNIVERSITY OF CAMBRIDGE

Institute of Continuing Education

A quick history of ancient mathematics and mathematical ideas

Start date	6 November 2020	**End date**	12 November 2020
Venue	Virtual Classroom		
Tutor	Piers Bursill-Hall	**Course code**	2021NDR412

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 6 November. Each session will last approximately one hour (often 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.

Friday 6.30pm

Session 1: Where do we begin? Around 500BC: the discovery of proof, the authority of maths and maths in the service of knowing the world, radical sceptics and an answer to Parmenides?

Saturday 6.30pm

Session 2: The early development of proof and then a clear research programme: starting points, non-co-measurables, a problem with space, and Zeno. A 5th century crisis, and ***no Pythagoras!***

Sunday 6.30pm

Session 3: Maths in Greek natural philosophy: Plato - *true* reality is like mathematics, knowledge from reason *vs.* knowledge from senses; Aristotle on mathematics - a very different role.

Monday 6.30pm

Session 4: Eudoxus, ca. 370 BC defines the next 2,200 years of maths: curves and the nature of space, non-co-measurables tamed, and astronomy started

Tuesday 6.30pm

Session 5: Mid 3rd century BC: Euclid: the *Elements* is the answer to what question? Archimedes, Apollonius, Aristarchus, Ctesibius and others: mathematical applications?

Wednesday 6.30pm

Session 6: Archimedes and curves: the breakthrough; mathematics and engineering, Heron to Hagia Sophia

Thursday 6.30pm

Session 7: (i) Mathematical astronomy: what do we actually know? (ii) The legacy: transmission of ancient maths to Persia, to Islam, and to the medieval Latin West.

Course syllabus

Aims:

The aim of this course is simple: to give a broad and non-technical outline of the development of the ideas in arithmetic and geometry by the ancient Greeks (in modern historiographical terms), and to put that story into the context of ancient Greek philosophy and natural philosophy (or science). We will talk about mathematical ideas and the context in which the modern idea of mathematics first emerged, and try to understand why things like Euclid's axiomatic foundations of geometry were so important at the time.

Content:

This is the first 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 ancient Greek development of geometry and mathematical astronomy, with some glances aside to arithmetic and astronomy and the long-term legacy of Ancient mathematics. It doesn't presume any detailed knowledge of maths or ancient Greek history. It's a history of ideas and *not* a technical history (no blackboards filled with equations and no homework assignments), and the aim is to understand *why* Greek maths became suddenly so important to Greek thinkers, and what were the broader consequences of this interest in – and status of – mathematics.

Presentation of the course:

The course will be live lectures on Zoom, 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, not homework to hand in), and is *not* about teaching you some mathematics but coming to an understanding of the role of some mathematics in early scientific thinking. There will be plenty of 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. To see how ancient Greek geometry developed in a rich epistemological context, answer the problems of natural philosophers and using the tools of natural philosophy.
3. Understand some of the many errors of popular history of mathematics (like the importance – or lack of importance – of Pythagoras, how the Greeks didn't discover irrational numbers, Archimedes is not the 'father' of the calculus, and so on).
4. Open your eyes (if they need opening!) to the idea that 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. Many can be found 2nd hand.

Please note:
There is pretty much nothing for you to read at an appropriate level. The literature on this subject is either out of date, difficult to approach, or very much unaffordable. There is lots of very (*very*) heavy scholarly literature, but you probably don't want to read this to start off with. You can find very technical and dry introductions to ancient maths, like Heath's *History of Greek Mathematics,* which was written well over 100 years ago and is still in print (!!) because there is virtually nothing to read in its place. In addition to being 100 years out of date, it is also a very difficult read. You will find that most of the histories of ancient mathematics are technical histories, and not histories of ideas and context, so there is very little I can recommend.

Author	Title	Publisher and date
Kline	*Mathematical Thought from Ancient to Modern Times vol 1*	Dates from the 1970s, part of an enormous 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 integrate Greek mathematics and scientific thinking a little.
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. Still hopelessly out of date. But at least it is a technical history that is slightly readable; I still wouldn't recommend it.
Wolpert, L *et.al*, eds.	*Science and mathematics in ancient Greek culture*	Ridiculously expensive so please don't even think of purchasing it, but has some decent chapters on ancient maths and allied sciences, and although very scholarly, is reasonably readable. Maybe.
Rihll, T.E.	*Greek science*	(C.U.P. 2012) Has a tolerable treatment of maths and ancient science and is affordable, esp.

		second hand. Rihll is up to date and competent.
Jones, A. *et al,* eds	*The Cambridge History of Science, vol.1 – Ancient Science*	Probably the best and up to date and readable source on ancient science and mathematics; too expensive to purchase (unless you get the kindle ed), but a digital copy of it will be made available to you. The relevant chapters are well worth reading.
Cuomo, S.	*Ancient mathematics*	Is up to date, but covers very little that these lectures will cover, sadly. And is an expensive paperback.

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: 04 November 2020