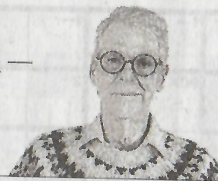# SUNDAY TIMES ARTICLE, 7 NOV 2021[1]

Maths means nothing if we don't know where the sums come from

Cambridge lecturer *Piers Bursill-Hall* had his history of mathematics course cancelled — but his loyal students were having none of it

As a lecturer in the subject, I'm biased but for me mathematics is a sublime form of beauty — for those lucky enough to experience it.

To the uninitiated, however, it can seem like an intimidating, closed world. But although it is an abstract subject, it is also an intensely human activity that takes place in a complex cultural, social and intellectual context. It is political — and will get more so with, for example, the rise of artificial intelligence. We mathematicians are just normally quite bad at talking about that. I talk about it a lot.

> **Mathematics is as much part of our history and lives as kings, battles, books and inventions**

For the past 40 years I have taught a history of maths course at Cambridge. But you may have read in The Times last week that this course, which was already non-examinable and non-obligatory, has been axed.

My students weren't best pleased, and rallied round and immediately formed a Cambridge University History of Maths Society. With our new-found power of Zoom, the lectures are going ahead more or less as normal. If nothing else, this enthusiasm is a measure of the extraordinary quality and character of my students. So what are the kinds of things we talk about, away from complex formulae and abstract reasoning?

We might discuss why the ancient Greeks so admired and valued geometry. It gave them a base of completely sure truths and certainty. They knew they were alone in the world, the unique owners of a new kind of thinking they called philosophy — some of which turned into what we call science.

Medieval mathematicians liked to study infinite series — such as $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} \ldots$ — the sum of which, if you carry on to infinity, gives a real, finite number. Some saw it as bringing them closer to God. God, after all, is infinite but appears in real, individual, particular things.

In the 15th and 16th centuries, uncertainty about the validity of traditional university-taught science, and the power of occult sciences such as alchemy, made some people realise that the certain and eternal truths of mathematics made it special: it was a small window into God's mind. This gave mathematics an authority like none other. I suspect a lot of mathematicians still think they are talking to God or studying God, even if they use other words.
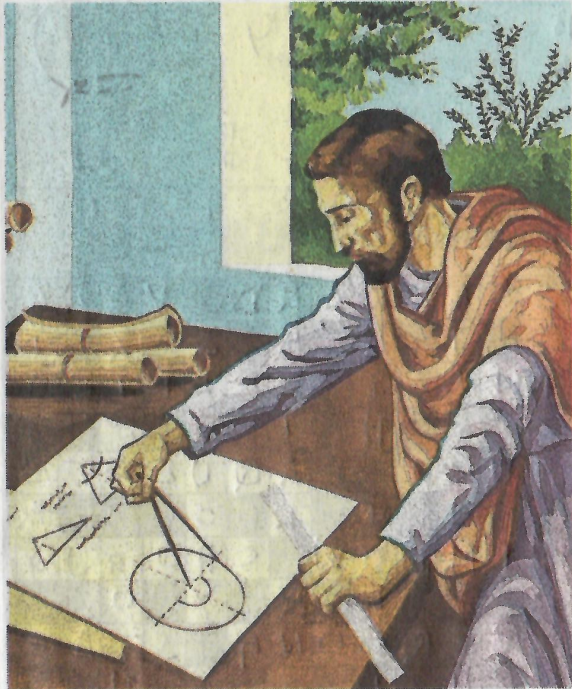
Geometry, devised by Euclid, held great power for Greeks

There's drama, violence and intrigue in the story of maths. I am amazed that the quest for a universal solution to cubic equations in 16th-century Italy has never been made into an opera. A very public squabble among half a dozen mathematicians introduced some of the most difficult and powerful new mathematical ideas, including complex numbers and the language of algebraic geometry.

Newton and his theory of universal gravity, the calculus and the start of modern physics would not have happened without it. But that was not before one of this group, Cardano, was accused and convicted of paedophilia and sexually harassing students, and then of heresy for casting Jesus's horoscope.

Another rival, Ferrari, became wealthy, retired young to live in Bologna with his widowed sister, and died soon after, poisoned by her, according to rumour.

Galileo brilliantly used mathematical arguments to get around objections to his Copernican theory of the universe, with the Earth orbiting around the Sun. His physics turned out to be entirely wrong but the mathematics meant that critics at the time were unable to disprove Galileo's arguments.

Some mathematical myths persist. The arithmetic we use – the symbols 0, 1, 2, 3, 4 etc and the methods we use to add, subtract, multiply, divide, make fractions and powers of numbers – we call this Hindu-Arabic arithmetic.

Yes, it comes from Hindu commercial arithmetic in the late 8th and early 9th centuries. However, it has nothing whatsoever to do with the Arabs but comes rather from the Muslims, mostly Persians, of Abbasid-ruled Baghdad. The system was brought into Europe by Italians who had traded with North Africa – including Leonardo Pisano (of Pisa), known as Fibonacci, in about 1200. He helped introduce "Hindu-Arabic" arithmetic into schools in Pisa, then Florence and the rest of Tuscany, and then quite quickly Italy and the rest of commercial Europe, spreading a new mathematical literacy among shopkeepers, merchants and craftsmen. Try multiplying 27 by 13 using Roman numerals – you can't. Banking, lending and debt became possible. This was the very birth of capitalism.

We ought to build more monuments to Leonardo of Pisa. He not only devised the Fibonacci number series – which is, trust me, super cool and beautiful – he changed Europe.

Mathematics matters. It is as much part of our history and culture as kings and battles and books and inventions. And it may have a transcendental abstract beauty but it is also human: buffeted and moved by the changing world of human society.
Piers Bursill-Hall is a lecturer in mathematics at Cambridge University