

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/370607773>

A History of Mathematics: From Ancient Origins to the Modern Era

Research · May 2023

DOI: 10.13140/RG.2.2.18860.33926

CITATIONS

0

READS

27,683

1 author:



Frank Veroustraete

REDSTAR CV&M

433 PUBLICATIONS 5,189 CITATIONS

SEE PROFILE



A History of Mathematics: From Ancient Origins to the Modern Era

Frank Veroustraete

Last Updated: May 7th 2023

Contents

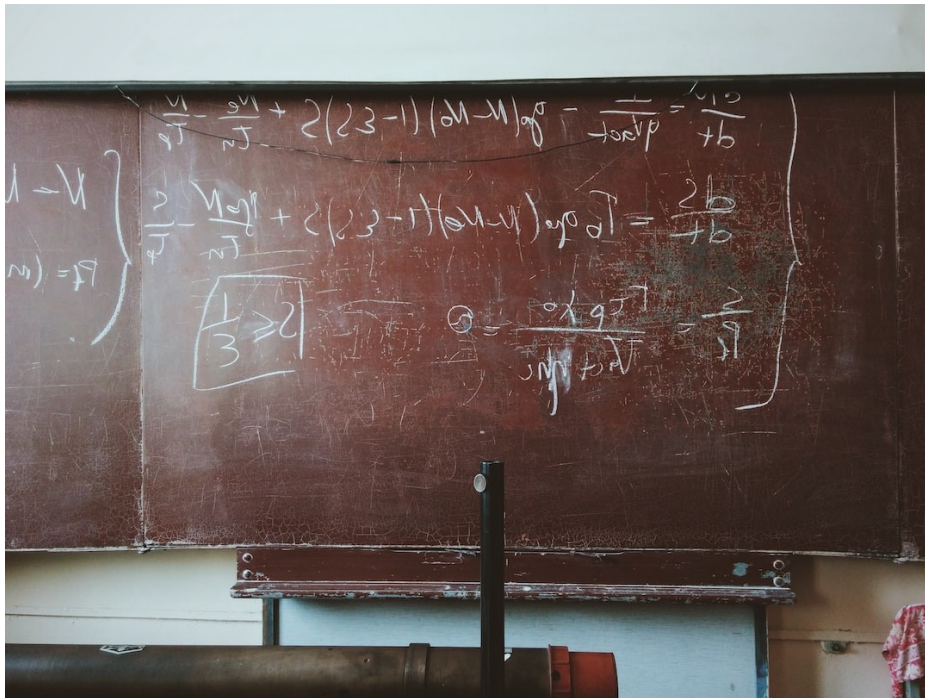
1. The beginning of mathematics: a brief history	1
2. Ancient Egyptian mathematics	2
3. Babylonian mathematics	3
4. Chinese mathematics	4
5. Greek mathematics	5
6. Indian mathematics	6
7. Medieval Islamic mathematics.....	7
8. Mathematics during the European Renaissance.....	8
9. 17 th and 18 th century mathematics in Europe	9
10. 19 th century mathematics in Europe.....	11
11. 20 th century mathematics.....	12
12. The 21 st century: a new era for the further development of mathematics?	12

1. The beginning of mathematics: a brief history

The origins of mathematics can be traced back to ancient times. The first evidence of mathematical activity dates back to the period between 35,000 and 25,000 BCE in Africa. The earliest known mathematical texts date back to the period 1900 to 1600 BC in the Old Babylonian period of Mesopotamia.

These texts are mostly concerned with solving practical problems, such as how to divide an inheritance among multiple heirs. However, they also contain some arithmetical problems that require the use of simple algebra.

The study of mathematics has since then evolved and expanded to become one of the most important and ubiquitous disciplines in the world. In the modern era, mathematics is used in a wide variety of fields, from physics and engineering to finance, economics and the development of mathematical models, numerical mathematics and ICT related mathematics.



https://unsplash.com/@roman_lazygeek

2. Ancient Egyptian mathematics

Ancient Egyptian mathematics is regarded as a cornerstone of the history of mathematics. Much of ancient Egyptian mathematics is contained in the Rhind Mathematical Papyrus, which dates from 1650 BC. This papyrus makes references to mathematical topics such as fractions, Pythagorean triples, and the geometry of triangles, circles, and rectangles.

The Egyptians had a sophisticated understanding of arithmetic, algebra, and geometry. They were able to quickly solve complicated mathematical problems by calculating second and third-order equations, as well as calculating the volume of objects like pyramids and cylinders.

The Egyptians also made great strides in astronomical calculations. By meticulously keeping records of the movement of the stars, they developed the first accurate calendar with a 365-day cycle. This allowed them to plan agricultural activities much more precisely than their predecessors.

Ancient Egyptian mathematics is credited with laying the foundations for many of the mathematical concepts we use today. It is an essential part of the history of mathematics and an important source of inspiration for modern mathematicians.



<https://unsplash.com/@juairiaa>

3. Babylonian mathematics

The second great civilization in the history of mathematics is of Babylonian origin. Babylonian mathematicians lived more than four millennia ago, and their influence extended to both Egypt and Greece.

Babylonian mathematicians contributed greatly to the study of astronomy, particularly in developing sophisticated techniques to calculate and predict the movement and orbits of the sun, moon, and planets. Their mathematics was rooted in the concept of a number-based system of the number 60 (for example, 60 seconds in a minute and 60 minutes in an hour).

In addition, Babylonian mathematicians invented a more primitive form of algebra. They were also able to solve polygonal area problems and could calculate square and cube roots, as well as calculate the number $[\pi]$.

Another important contribution of Babylonian mathematics was the use of fractions. While we are familiar with the notion of a fraction today, the Babylonians were among the first to understand how to handle them with precision.

The influence of Babylonian mathematics can still be felt today. Many of the techniques and methods used by the Babylonians are still used in modern mathematics, and the legacy of this great civilization continues to live on.



<https://unsplash.com/@juairiaa>

4. Chinese mathematics

The fourth major civilization in the history of mathematics is ancient Chinese mathematics. It was born out of many centuries of development and continued to evolve over six thousand years and still counting.

Chinese mathematicians had a strong emphasis on practical applications. They developed important disciplines in mathematics, including geometry, algebra, and trigonometry. Chinese mathematicians were also the first to calculate the value of the number $[\pi]$ to five decimal places.

Another important invention of Chinese mathematics is the abacus, a counting frame, or a calculating tool that has been used since ancient times and which is still used in many parts of the world as we speak. Chinese mathematicians also developed the I-Ching, a technique for divination, and astrological calculations. Divination is the practice of seeking knowledge of the future or the unknown by supernatural means

The influence of Chinese mathematics can still be felt in modern mathematics. For instance, the concept of negative numbers was first proposed by the Chinese mathematician Yang Hui



in the 13th century. The yin-yang symbol, the symbol of duality, is also a creation of Chinese mathematicians.



<https://unsplash.com/@rrajputphotography>

5. Greek mathematics

Greek mathematics is the fifth and most influential branch of mathematics in the world today. It is credited with bringing a more formal analysis and axiomatic system to the mathematics of the ancient world.

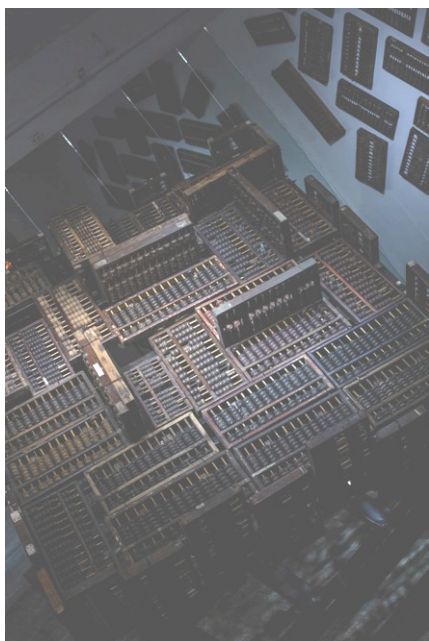
Greek mathematicians were responsible for the introduction of many fundamental mathematical concepts and theorems, such as the Pythagorean theorem and the Pythagorean triangle, Euclid's Elements, and the concept of formal proof.

A few of the most notable Greek mathematicians are:

- Euclid (ca.325 BC). Is considered to be one of the most influential ancient mathematicians, Euclid is the founder of the influential "Elements of Mathematics" and is oftentimes referred to as the "father of geometry". The "Project Gutenberg" archive (<https://www.gutenberg.org>) is an important source of a more detailed description of the work of Euclid.



- Apollonius of Perga (ca. 262 BC). Is known for his work on conic sections, ellipses and parabolas, as well as his generalization of the Pythagorean theorem.
- Archimedes of Syracuse (ca. 287 BC-212 BC). Is a mathematician of ancient Greece. He made numerous groundbreaking developments in the fields of mathematics, natural sciences and engineering. He is best known for the "Archimedes Principle", the law of levers and the "Archimedes theorem".
- Pythagoras (ca. 570 BC-40 BC). Is the supposed founder of the "Rule of Pythagoras Theorem". Pythagoras theorem states that “In a right-angled triangle, the square of the hypotenuse side is equal to the sum of squares of the other two sides“. The sides of this triangle have been named Perpendicular, Base and Hypotenuse.



<https://unsplash.com/de/@sambalye>

6. Indian mathematics

Indian mathematics dates back to the Vedic period of the Indian history. Indian mathematicians were a major source of mathematical knowledge. The influence of Indian mathematics extended to various countries, particularly in the areas of Algebra and Trigonometry.

The Indian mathematician, Aryabhata, was one of the earliest recorded mathematicians in Indian history. He is credited with developing the concept of the sine and cosine rules. He also made an important contribution to number theory and algebra with the solved cubic equations equation and the area of a triangle.

Indian mathematics also contributed to the development of zero and the decimal system. The Indian mathematician Bhaskara developed the concept of proof by contradiction. He also



developed some fundamental algorithms. Similarly, Brahmagupta made important contributions to mathematics through his writings on number theory, algebra and other topics.

Indian mathematics also contributed to the modern-day calculus as developed by Isaac Newton and Gottfried von Leibniz. Indian mathematicians including Madhava and Nilakantha initiated the development of modern calculus.

Indian mathematics also made contributions to the field of computational geometry. The Indian mathematician Mahāvīra developed the theorem which states that the area of a cyclic quadrilateral is equal to the sum of the areas of a triangle on each side of the quadrilateral.



<https://unsplash.com/@makmphotography>

7. Medieval Islamic mathematics

Medieval Islamic mathematics made a quite significant contribution to mathematics. One of the prominent figures of this period was Sharaf al-Din al-Tusi. He developed the concept of number systems and algebra building on the principles of Euclidean geometry.

The Islamic mathematician Muhammad ibn Musa al-Khwarizmi developed the basis of algebra, which is still in use today. He is also responsible for introducing the concept of reduction which is used in solving linear and quadratic equations.

Many other Islamic mathematicians followed in the footsteps of al-Khwarizmi, and developed other concepts such as the sine and cosine rules.



Also, during this period, Islamic mathematicians developed the concept of optimization. For example, the development of the zero-sum game and the concept of a Nash equilibrium by Nashid al-Majid.

Finally, Islamic mathematicians also developed the concept of Boolean algebra, a system that has been used in many fields such as medicine and engineering. This system has found applications in computer science and even artificial intelligence (AI).



<https://unsplash.com/@blunkorama>

8. Mathematics during the European Renaissance

One of the most influential periods for mathematics was during the Western European Renaissance period. This era saw the development of some of the most significant mathematical advancements.

The Renaissance was a period of intellectual freedom, and this era saw the development of humanities such as philosophy, literature, and art. This period also had a profound impact on mathematics.





One example of a mathematician who contributed greatly to the discipline in this period was Leonhard Euler. He was a Swiss mathematician known for his work in astronomy, calculus, number theory, and graph theory. He was able to solve equations and problems with remarkable accuracy and was able to develop some of the most influential equations of mathematics. Euler contributed greatly to the development of calculus and graph theory and also wrote an influential treatise on the calculus of variations.

Another example is Joseph-Louis Lagrange. He was an Italian mathematician who primarily focused on the field of calculus. He developed the Lagrange identity and Lagrange number systems and wrote influential books on the calculus of variations. He is credited with developing the calculus of finite differences and differential equations.

The 1800s also saw the emergence of the field of abstract algebra. This concept was developed by mathematicians such as Augustin-Louis Cauchy and Évariste Galois and was used to solve equations and problems of an abstract nature. Abstract algebra would eventually become one of the most influential developments of mathematics and would have popular applications in a variety of scientific fields.



<https://unsplash.com/@mrthetrain>



10. 19th century mathematics in Europe

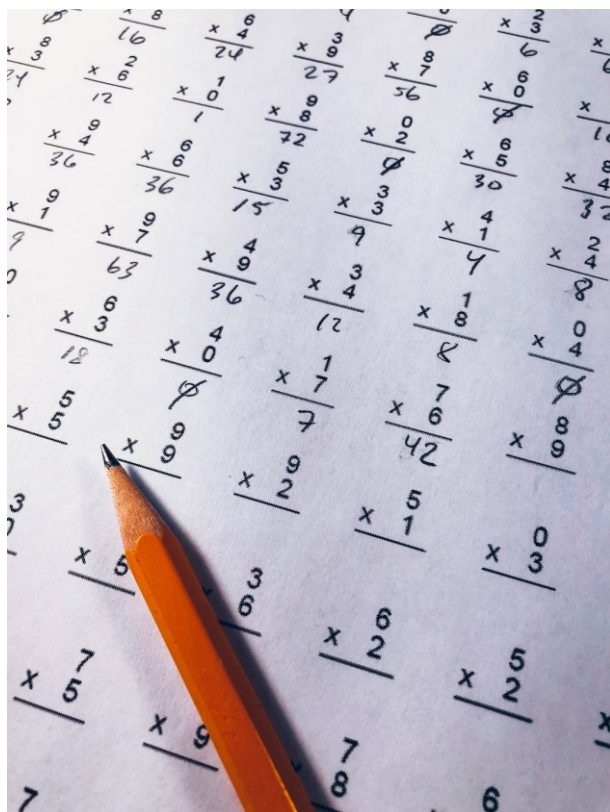
The 19th century saw mathematics develop into an even more advanced and popular field. Many of the significant developments of early mathematics were expanded upon. Mathematics also began to be taught at universities, gradually increasing its popularity with students and academics.

Rene Descartes is considered to be one of the most influential mathematicians of the 19th century. He was a French mathematician whose research focused on algebraic geometry and analytical geometry. Descartes used a mathematical coordinate system to represent geometric figures. This Cartesian coordinate system is widely used in mathematics, as we speak.

Georg Cantor was another influential mathematician of this period. He was a German mathematician who is credited with developing the field of set theory. He used sets of numbers and numbers to define mathematics. Cantor is also credited with developing the concept of infinity, which is now a cornerstone of modern mathematics.

The 19th century also saw the development of the field of mathematical analysis, which was led by mathematicians like Karl Weierstrass and Sofia Kovalevskaya. This field focused on analyzing and solving mathematical equations. Weierstrass was also the first mathematician to develop the concept of a function.

Overall, the 19th century was a period of great progress for mathematics, with revolutions in the fields of set theory, analysis, and calculus shaping the field for centuries to come.





11. 20th century mathematics

The 20th century was a period of great progress in mathematics and technology. Mathematics became an ever-expanding field due to advances in computer technology. Throughout the century, mathematics had a huge impact on society, allowing for inventions such as computers, the internet, and cellphone technology.

The 20th century saw major developments in the field of algebra, which is the study of equations and operations. Mathematicians like David Hilbert and Emmy Noether were pioneers in the field, introducing new techniques and methods, still used today. They also contributed to the development of abstract algebra, focussing on the study of mathematical objects, such as groups and rings.

Calculus was also heavily studied throughout the 20th century, giving birth to new fields such as real analysis and differential equations. Scientists like Stephen Hawking, Robert A. M. Sternberg, Carl Gauss, and Isaac Newton all contributed to the development of these fields.

Chance and probability also made significant progress during the 20th century. Mathematicians like Andrei Kolmogorov and Alan Turing developed new techniques to analyze and assess risk, allowing for the successful management of decision-making processes. Alan Turing also developed one of the first electronic computers, which he used to decode the German military 'enigma' code.

Overall, 20th century mathematics has had a profound impact on society. It can even be stated that current knowledge in mathematics has been made possible, due to the advances made during mathematics during this 20th century.

12. The 21st century: a new era for the further development of mathematics?

The 21st century started with a big leap forward for mathematics. As during the previous century, the 21st century has seen major technological advances allowing mathematics to reach new heights. This century has already seen massive advances in the fields of algebra, calculus, chance, and probability all thanks to massive progress in computer technology.

Thanks to advancements such as AI, deep learning and neuroscience, mathematicians are better prepared than ever to tackle complex problems. Fields such as graph theory and network analysis are growing in popularity and mathematicians are using algorithms and data mining techniques to produce practical solutions to real-world problems.

The 21st century has also seen a surge in the popularity of mathematics tournaments and competitions as well as intellect-based gaming. Such competitions are now regularly held



across the world and hundreds of students take part in them. This has allowed students to hone their mathematical skills and gain knowledge that they can put to work in their real lives.

Overall, the 21st century is already a revolutionary time for mathematics and its scope for innovation is larger than ever before. We have already seen advancements in fields such as AI and machine learning and it is only a matter of time before we see more impressive leaps ahead in the field of mathematics, advanced statistics and big dataset analysis.

Just to mark the advance made with regard to the number $[\pi]$, the current record now stands at about 31.4 trillion digits, thousands of times more than the Chudnovskys' home-brewed supercomputer managed. It was [calculated](#) by a Google employee over 121 days using a freely available program called [y-cruncher](#) and verified with another 48 hours of number-crunching sessions. The calculation took up about as much storage space as the entire digital database of the Library of Congress. Emma Haruka Iwao, the woman that established the new record, has been calculating $[\pi]$ on computers [since she was a child!](#)

Iwao's feat of calculation increased humanity's collective knowledge of the digits of $[\pi]$ by about 40%. The previous record stood at over 22 trillion digits, worked out after 105 days of computation on a Dell server, also using y-cruncher. That program, which uses both the Ramanujan and Chudnovsky [formulas](#), has been used to find record numbers of digits of not only $[\pi]$, but also of other endless, irrational numbers, including [e](#), $\log 2$, the [golden ratio](#) and others!