History of Mathematics

According to the *Biography Channel website,* ancient Greek philosopher Aristotle was born circa 384 B.C. in Stagira, Greece. When he turned 17, he enrolled in Plato's Academy. In 338, he began tutoring Alexander the Great. In 335, Aristotle founded his own school, the Lyceum, in Athens, where he spent most of the rest of his life studying, teaching and writing. Aristotle died in 322 B.C., after he left Athens and fled to Chalcis.

George Boole (1815–1864) was an English mathematician and a founder of the algebraic tradition in logic. At 16 he worked at an elementary school and by age 20 had opened his own school. He worked as a schoolmaster in England and from 1849 until his death as professor of mathematics at Queen's University, Cork, Ireland. He revolutionized logic by applying methods from the then-emerging field of symbolic algebra to logic. Where traditional (Aristotelian) logic relied on cataloging the valid syllogisms of various simple forms, Boole's method provided general algorithms in an algebraic language which applied to an infinite variety of arguments of arbitrary complexity. These methods were outlined in two major works, *The Mathematical Analysis of Logic* (1847) and *The Laws of Thought* (1854). (Stanley Burris)

According to *Encyclopædia Britannica website*, **Georg Cantor,** (born March 3, 1845, St. Petersburg, Russia—died Jan. 6, 1918, Halle, Ger.), German mathematician who founded set theory and introduced the mathematically meaningful concept of transfinite numbers, indefinitely large but distinct from one another.

According to *Notable Names Data Base*, Augustus De Morgan, English mathematician and logician, was born in June 1806, at Madura, in the Madras presidency. One marked characteristic of De Morgan was his intense and yet reasonable love of books. He was a true bibliophile and loved to surround himself, as far as his means allowed, with curious and rare books. He revelled in all the mysteries of watermarks, title pages, colophons, catchwords and the like; yet he treated bibliography as an important science. As he himself wrote, "the most worthless book of a bygone day is a record worthy of preservation; like a telescopic star, its obscurity may render it unavailable for most purposes; but it serves, in hands which know how to use it, to determine the places of more important bodies." A sample of De Morgan's bibliographical learning is to be found in his account of Arithmetical Books, from the Invention of Printing (1847), and finally in his Budget of Paradoxes.

Born in Ulm, Württemberg, Germany in 1879, Albert Einstein developed the special and general theories of relativity. In 1921, he won the Nobel Prize for physics for his explanation of the photoelectric effect. Einstein is generally considered the most influential physicist of the 20th century. He died on April 18, 1955, in Princeton, New Jersey. (*Biography Channel website*)

Emilie, Marquise du Chatelet (1706-1749) participated in the scientific activity of the generation after Newton and Leibniz. Educated in science, music, and literature, she was studying mathematics at the time (1733) she began a long intellectual relationship with the philosopher **Francois Voltaire** (1694-1778). She and Voltaire competed independently in 1738 for a prize offered by the French Academy on the subject of fire. Although du Chatelet did not win, her dissertation was published by the academy in 1744. During the last four years of her life she translated Newton's *Principia* from Latin into French – the only French translation to date. (Miller, Heeren, and Hornsby 95)

Euclid's *Elements* as translated by Billingsley appeared in 1570 and was the first English language translation of the text – the most influential geometry text ever written.

Unfortunately, no copy of *Elements* exists that dates back to the time of Euclid (circa 300 B.C.), and most current translations are based upon a revision of the work prepared by Theon of Alexandria.

Although *Elements* was only one of several works of Euclid, it is, by far, the most important. It ranks second only to the Bible as the most published book in history. (Miller, Heeren, and Hornsby 450)

Euclidean tools, the compasses and unmarked straightedge, proved to be sufficient for Greek geometers to accomplish a great number of geometric constructions. Basic constructions such as copying an angle, constructing the perpendicular bisector of a segment, and bisecting an angle are easily preformed and verified.

There were, however, three constructions that the Greeks were not able to accomplish with these tools. Now known as the *three famous problems of antiquity*, they are:

1. To trisect an arbitrary angle;
2. To construct the length of the edge of a cube having trice the volume of a given cube;
3. To construct a square having the same area as that of a given circle.

In the nineteenth century it was learned that these constructions are, in fact, impossible to accomplish with Euclidean tools. Over the years other methods have been devised to accomplish them. For example, trisecting an arbitrary angle can be accomplished if one allows the luxury of marking on the straightedge! But this violates the rules followed by the Greeks. (Miller, Heeren, and Hornsby 465)

The word **paradox** in Greek originally meant "wrong opinion" as opposed to orthodox, which meant "right opinion". Over the years, the word came to mean self-contradiction. An example is the statement "This sentence is false." By assuming it is true, we get a contradiction; likewise, by assuming it is false, we get a contradiction. Thus, it's a paradox. Before the twentieth century it was considered a paradox that any set could be placed into one-to-one correspondence with a proper subset of itself. This paradox, called **Galileo's paradox** after the sixteenth-century mathematician and scientist

Galileo (see the picture), is now explained by saying that the ability to make such a correspondence is how we distinguish infinite sets from finite sets. What is true for finite sets is not necessarily true for infinite sets. (Miller, Heeren, and Hornsby 75)

According to Mike Hoffman, Leonhard Euler (1707-1783) was arguably the greatest mathematician of the eighteenth century (His closest competitor for that title is Lagrange) and one of the most prolific of all time; his publication list of 886 papers and books may be exceeded only by Paul Erdös. Euler's complete works fill about 90 volumes. Remarkably, much of this output dates from the last two decades of his life, when he was totally blind. Euler's important contributions were so numerous that terms like "Euler's formula" or "Euler's theorem" can mean many different things depending on context. Just in mechanics, one has Euler angles (to specify the orientation of a rigid body), Euler's theorem (that every rotation has an axis), Euler's equations for motion of fluids, and the Euler-Lagrange equation (that comes from calculus of variations). The "Euler's formula" with which most American calculus students are familiar defines the exponentials of imaginary numbers in terms of trigonometric functions. But there is another "Euler's formula" that (to use the modern terminology adopted long after Euler's death) gives the values of the Riemann zeta function at positive even integers in terms of Bernoulli numbers. There are both Euler numbers and Eulerian numbers, and they aren't the same thing. Euler's study of the bridges of Königsberg can be seen as the beginning of combinatorial topology (which is why the Euler characteristic bears his name).

Gottfried Wilhelm Leibniz, (born July 1 [June 21, Old Style], 1646, Leipzig [Germany]—died November 14, 1716, Hannover, Hanover), German philosopher, mathematician, and political adviser, important both as a metaphysician and as a logician and distinguished also for his independent invention of the differential and integral calculus. (*Encyclopædia Britannica website*)

According to the *Biography Channel website,* considered a pioneer in the field of philosophy, Bertrand Russell was awarded the Nobel Prize in Literature in 1950 for his numerous writings. He is perhaps better known, though, for his political activism. A prominent anti-war activist, he has been imprisoned twice by the British government.

According to the *Biography Channel website,* Alfred North Whitehead was born February 15, 1861, in Ramsgate, England. His *Treatise on Universal Algebra* (1898) extended Boolean symbolic logic. He collaborated with Bertrand Russell on the epochal *Principia Mathematical* (1910–1913), which attempted to establish the thesis of logicism. *Process and Reality* (1929), was his major work in metaphysics. He received the Order of Merit in 1945.

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