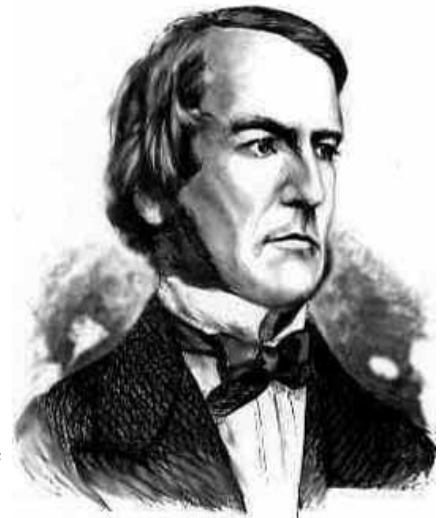


## George Boole

**George Boole** (November 2, 1815 – December 8, 1864) set the path for a great deal of the computing and information technological innovation that is taken for granted today, such as digital recordings, computer programming, electrical engineering, satellite pictures, telephone circuits, television, and the Internet. Through sheer grit and genius, Boole wrote the first work on symbolic logic. He explored the analogy between the symbols of algebra and those of logic as used to represent logical forms and syllogisms. His formalism, operating only on the symbols 0 and 1, became the basis of what is now known as Boolean algebra. He combined logical elements using operators the *and*, *or*, *not*, *if...then*. Given any propositions involving any number of terms, he showed how to draw any conclusion logically contained in the premises by purely symbolic treatment of the premises. While it is unlikely he had computers in mind, switching theory is grounded in the algebra named for him.



In the year that Napoleon met his Waterloo Boole was born in the English industrial town of Lincoln in Lincolnshire, the eldest son of a shoemaker. His father had a passion for science, in particular, optics, and taught his son mathematics. Wishing to balance his education, he encouraged his son to help with the construction of cameras, kaleidoscopes, telescopes and sundials. Boole's mother's influence was as strong as his father's. She instilled in her family a love for truth and beauty and the belief that one's character should be developed through music and art. Boole had only a common school education, since his family could not afford to send him to a grammar school. He was fortunate to receive instruction in Latin from a bookseller and printer, who opened his extensive library to the youth. Boole read widely in history, geography, and science. He also taught himself Greek, French, German, and

Italian, and that allowed him to read Continental scientific publications before they appeared in English translations.

Boole never studied for a university degree. Instead, at the age of 16, he became an assistant schoolteacher. Dissatisfied with the low wages, he looked for another profession. As he could not afford the Army or Law, he decided to study to become an Episcopal priest, but after four years of preparation for the clergy, his parents persuaded him to return to teaching. At the age of twenty, he opened his own elementary school for young boys and girls, where, stimulated by this experience, he developed his educational theories and published an essay on education. Finding that he needed to learn more mathematics, he mastered the work of Newton, Laplace and Lagrange. This study resulted in his first mathematical publication “Researches on the Theory of Analytical Transformations” (1838). In 1844 The Royal Society awarded him a gold medal for a paper he wrote on the calculus of operators. Boole became friendly with Augustus De Morgan and took an interest in the DeMorgan’s controversy over logic with the Scottish philosopher Sir William Hamilton, (not to be confused with Irish mathematician Sir William Rowan Hamilton). As a result, Boole published *The Mathematical Analysis of Logic* (1847), which firmly established his reputation as a mathematician. In this work Boole first introduced his ideas of symbolic logic and demonstrated that logic, as presented by Aristotle, could be rendered in the form of algebraic equations.

In 1849 Boole was appointed professor of mathematics at Queen’s College in Cork, Ireland. Five years later he published his most famous work, *An Investigation of the Laws of Thought on which are founded the Mathematical Theories of Logic and Probabilities*, which contained the concepts that now constitute Boolean algebra. He held that any consistent symbolic logical system was a part of mathematics, and that the rules of logic were to be constructed not from ordinary language, but rather from purely formal elements. In 1860 he published a book on the calculus of finite differences that

remains a standard work on the subject. Boole was very popular with his students and colleagues, but he often became so engrossed in his thoughts that he was completely unaware of anything happening around him. Once his class arrived for his lecture, only to find him deep in thought. After waiting for some time, they all quietly left. He never saw them come in or leave, and later concluded that the entire class had been absent. One of his students recalled that when Boole was lecturing, “He looked, not like a professor writing a demonstration on a blackboard, but like an artist painting from a vision.” Boole suffered from eye disease and a hereditary lung problem, aggravated by the damp Irish climate. On November 24, 1864, he walked two miles from his home to the College in a heavy rain. Soaked, he lectured in his wet clothes, caught a cold, and after several weeks of fighting a lung infection, died of pneumonia at age 49.

Boole’s students and colleagues walked in his funeral procession through the town in full academic regalia. There is a memorial window honoring Boole located at the east end of the Aula Maxima (Great Hall) of the College (now named University College Cork). It consists of figures of Archimedes, Leonardo da Vinci, Copernicus, Hipparchus, Galileo, Bacon, Napier, Newton, Pascal, Leibniz, Descartes, Strabo, and Ptolemy surrounding a central panel of Euclid and Aristotle seated at his writing desk. The Boole Library opened in 1983 and near by is the Boole Lecture Hall. Boole’s friends in Lincoln collected funds to pay for a large stained-glass window to honor him. Known as the “Teaching Window” it is located in the Cathedral Church of Lincoln. The central medallion depicts Christ with the teachers in the temple. The story of “the calling of Samuel,” one of Boole’s favorite passages in the Bible is depicted in the lower medallion and Christ teaching “Render to Caesar” appear at the top. Beneath the window is a brass plaque:

“In memory of George Boole, Dr. of Laws, of Lincoln. A man of acutest intellect and manifold learning, who, being specially exercised in the severer sciences, diligently explored the

recesses of mathematics and happily illuminated them by his writings. He was carried off by an untimely death in 1864.”

In 1855 Boole married Mary Everest, a brilliant woman, quite talented in mathematics. She was the daughter of a minister Dr. Thomas R. Everest and his wife, Mary Ryall, and the niece of Sir George Everest, surveyor-general of India, after whom Mt. Everest is named. She was 18 when she met George Boole, then twice her age, who became her mathematics tutor. Mary Boole outlived her husband by 52 years. After her husband’s death, she taught mathematics to future governesses in the women’s section of Queens College. Of their five daughters, their eldest, Mary Ellen, taught in Japan at the turn of the century and married a mathematician and writer of science, who took a second wife and was tried for bigamy before fleeing the country. Margaret was an artist, while Alicia (called Alice) developed an amazing skill with four-dimensional geometry. She introduced the term *polytopes* to describe a four dimensional convex solid. She found that there were exactly six regular polytopes bounded by 5, 16 or 600 tetrahedra, 8 cubes, 24 octahedra or 120 dodecahedra. Daughter Lucy was the first female professor to head the chemistry department of Royal Free Hospital, London. The youngest, Ethel became a writer and translator and married the revolutionary, Wilfryd Michal Woynicz.

**Quotation of the Day:** “No matter how correct a mathematical theorem may appear to be, one ought never to be satisfied that there was not something imperfect about it until it also gives the impression of being beautiful.” – George Boole