

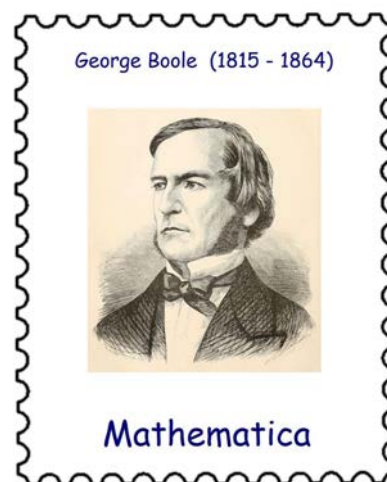
GEORGE BOOLE (November 2, 1815 – December 8, 1864)

by HEINZ KLAUS STRICK, Germany

Until the middle of the 19th century there was only one university in Ireland, *Trinity College* in Dublin, founded in 1592, where WILLIAM ROWAN HAMILTON (1805-1865) and others taught.

In 1845 the British Queen VICTORIA ordered the foundation of two more colleges (*Queen's Colleges*) in Ireland, in Cork and in Belfast.

In 1849 GEORGE BOOLE was appointed to the newly established Chair of Mathematics in Cork – a man who had never had a school education and never attended university. BOOLE's appointment was nevertheless uncontroversial.



GEORGE BOOLE was the eldest child of a Lincoln shoemaker and grew up in poverty. The parents had initially hoped in vain for a child for nine years but after GEORGE, three more children followed. The father was not too intensively involved in his trade. He was more interested in technical equipment, for example in the construction of optical instruments.

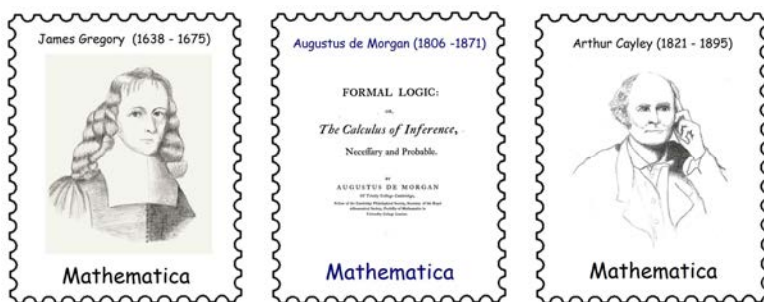
First GEORGE attended a school run by a friend of the father, then the public primary school. His father aroused GEORGE's interest in mathematics and the boy received Latin lessons from a bookseller friend. GEORGE took a great liking for this ancient language and also taught himself Greek. When the father proudly published the translation of a poem by the Greek poet MELEAGER OF GADARA (c. 100 BC), this caused a stir, since it was hard to believe that a 14-year-old was capable of such a creation, and there was even talk of plagiarism from unknown sources.

In 1831 his father had to give up his workshop and from then on GEORGE took over to provide for a livelihood for his parents and siblings. The 16-year-old began working as an assistant teacher at a school in Doncaster, 40 miles away, and temporarily even in Liverpool. In his spare time he immersed himself in SYLVESTRE FRANÇOIS LACROIX's work *Differential and integral calculus*, and also learnt German and French without any help from others. At the age of 19 GEORGE BOOLE opened his own school in Lincoln.

At this time a library which kept scientific books was opened in Lincoln. GEORGE BOOLE used every spare minute to work through ISAAC NEWTON's *Principia*, PIERRE-SIMON LAPLACE's *Traité de mécanique céleste* and JOSEPH-LOUIS LAGRANGE's *Mécanique analytique*.



In 1838, he took over a boarding school in a neighbouring village and his parents and siblings looked after the children in his care. In the following year BOOLE submitted a paper, *Researches on the Theory of Analytical Transformations* on the solution of special differential equations, to the Cambridge Mathematical Journal, founded by DUNCAN GREGORY. GREGORY, a descendant of JAMES GREGORY, offered BOOLE the chance to study mathematics with him at Cambridge, but the latter declined because of his family responsibilities.



DUNCAN GREGORY directed BOOLE's interest to algebraic questions. In 1842 BOOLE corresponded with AUGUSTUS DE MORGAN on his ideas on how algebraic methods could be used to solve differential equations and BOOLE was awarded a *Royal Society Gold Medal* for his paper *On a General Method of Analysis*.

Within a short time BOOLE had made a name for himself in scientific circles. In 1846, when it became clear that the British Crown was going to establish two new universities in Ireland, he applied for one of the chairs of mathematics to be established, with strong support from DE MORGAN and ARTHUR CAYLEY, among others. And even before his appointment, BOOLE presented a paper in 1847 entitled *Mathematical Analysis of Logic*.

Although he later described this publication as premature and incomplete, it already contained essential insights without which our present-day computer technology (*BOOLEan algebra*) would be unthinkable. In the paper he pointed out the analogies between the symbols and operations of algebraic and logical forms, so that algebraic rules can be applied to the execution of logical inferences. In his main work *An investigation into the Laws of Thought, on which are founded the Mathematical Theories of Logic and Probabilities* from 1854, he explained the thoughts he had already expressed in 1847 and presented them systematically. As can be seen from the title of the book, he also recognised the applicability of logical laws to the calculation of probabilities.

Every true statement and combination of statements could be assigned the value 1, every false one the value 0. Compound statements could be described as bivalent truth functions. The conjunction $x \wedge y$ of two statements corresponded to the multiplication of the corresponding truth values, the disjunction $x \vee y$ to addition, the negation $\neg x$ to the subtraction $1 - x$ of the truth values. For the operations \wedge , \vee , \neg and any statements, the laws known from algebra applied: the commutative law, the associative law and even two distributive laws. Also, there were neutral elements and a complement (which was not the same as the inverse element).

Laws	Propositional logic	Arithmetic laws
Commutativity	$x \wedge y = y \wedge x$, $x \vee y = y \vee x$	$x \cdot y = y \cdot x$, $x + y = y + x$
Associativity	$x \wedge (y \wedge z) = (x \wedge y) \wedge z$, $x \vee (y \vee z) = (x \vee y) \vee z$	$x \cdot (y \cdot z) = (x \cdot y) \cdot z$ $x + (y + z) = (x + y) + z$
Distributivity	$x \wedge (y \vee z) = (x \wedge y) \vee (x \wedge z)$, $x \vee (y \wedge z) = (x \vee y) \wedge (x \vee z)$	$x \cdot (y + z) = (x \cdot y) + (x \cdot z)$
Existence of neutral element	$1 \wedge x = x$, $0 \vee x = x$	$1 \cdot x = x$, $0 + x = x$
Existence of complements	$x \wedge \neg x = 0$, $x \vee \neg x = 1$	

BOOLE quickly gained the trust and recognition of his students and colleagues in Cork and was elected Dean in 1850. However, he did not feel particularly comfortable in Cork and soon expressed his interest in moving to a university in England to DE MORGAN, as Cork was a place of conflict for fanatical religious reasons.

BOOLE became friends with the professor of Greek in Cork and met his 18-year-old niece MARY EVEREST during a visit.

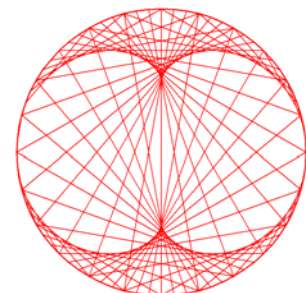
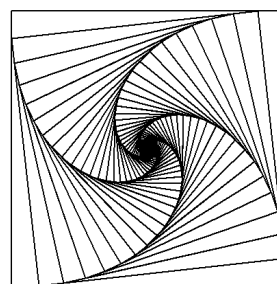
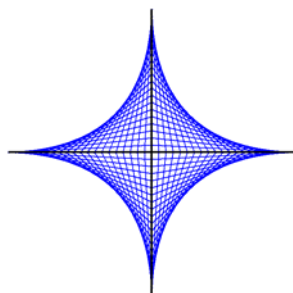
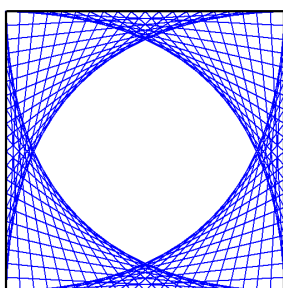
Another uncle of MARY EVEREST was Sir GEORGE EVEREST, who was responsible for the *Great Trigonometrical Survey* of India and the measurement of the *Great Arc* from 1832 to 1841. In his honour the highest mountain he surveyed was named after him.



The mutual sympathy which also led to BOOLE's visit to the EVEREST family in Gloucestershire developed into a strong affection. When MARY's father died in 1855, leaving his daughter penniless, the two married. In this happy marriage five daughters were born. As MARY herself had a keen interest in mathematics (she had had intensive private lessons as a child), she attended her husband's lectures – unusual for a woman at that time – and she advised her husband on his writing.

The family's happiness was abruptly ended by the tragic death of GEORGE BOOLE. On his way to the university, he got completely soaked in pouring rain, but dutifully conducted his lecture. His wife tried to fight the fever that set in at home with the then widespread method of "healing by strengthening the cause of the illness", but the cold water showers aggravated BOOLE's condition and he died of pneumonia.

After the death of her husband, MARY EVEREST returned to England and took up a post as librarian at *Queen's College* in London. She wrote about mathematical education (including *The Preparation of the Child for Science* and *Philosophy and Fun of Algebra*) and taught *curve stitching* to improve children's imagination. One of her daughters (ALICIA BOOLE STOTT) became famous for her research on regular 4-dimensional bodies, and she coined the term *polytope* for these higher dimensional convex structures.



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<https://www.spektrum.de/wissen/george-boole-seinen-arbeiten-verdanken-wir-den-computer/1585360>

Translated 2020 by John O'Connor, University of St Andrews

Here an important hint for philatelists who also like individual (not officially issued) stamps.
 Enquiries at europablocks@web.de with the note: "Mathstamps".

