

BARTEL LEENDERT VAN DER WAERDEN

(February 2, 1903 – January 12, 1996)

by HEINZ KLAUS STRICK , Germany

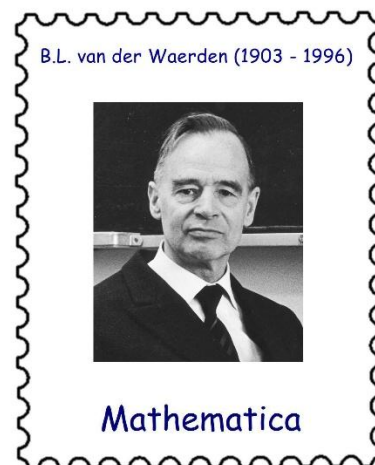
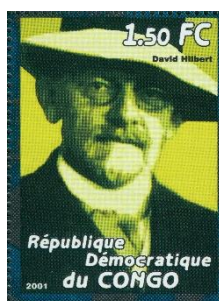
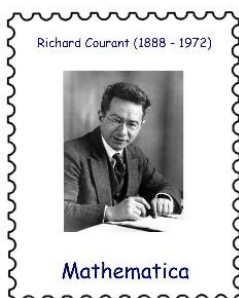
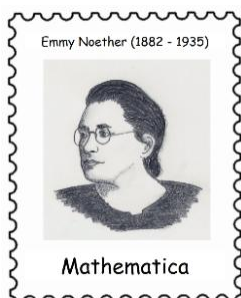
BARTEL LEENDERT VAN DER WAERDEN was one of the few mathematicians of the 20th century who maintained a comprehensive overview of the various subfields of the discipline until the very end. During his long life, this generalist published numerous treatises on algebra and algebraic geometry, group and number theory, topology and axiomatic geometry, analysis, combinatorics, probability theory and statistics, as well as on the history of mathematics and astronomy in antiquity. He also made significant contributions to quantum mechanics and philosophy.

BARTEL LEENDERT was the eldest of three sons of THEODORUS VAN DER WAERDEN and DOROTHEA ADRIANA ENDT. His father was a mathematics teacher and a member of the Social Democratic Workers' Party in the North Holland Regional Parliament.

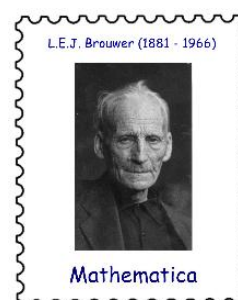
The boy grew up in Amsterdam, attended primary school there, and later the *Hogere Burger School*, where his mathematical talent became apparent at an early age. As he later recounted in an interview, he had already independently derived the theorems of trigonometry even before they were covered in class.

At the age of 16, he began studying mathematics at the University of Amsterdam. He was one of the few students who could follow the demanding lectures of LUITZEN EGBERTUS BROUWER. The self-confident, occasionally arrogant student had no problem interrupting the professors during their lectures, asking them questions, or pointing out their errors.

After successfully completing his studies, he moved to Göttingen in the winter semester of 1924/25 (financed by his parents). At that time it was a world-renowned centre of mathematical research. There, VAN DER WAERDEN attended lectures on algebra by EMMY NOETHER, on topology by HELLMUTH KNESER, and on mathematical methods of physics by RICHARD COURANT (using the textbook by COURANT and HILBERT).



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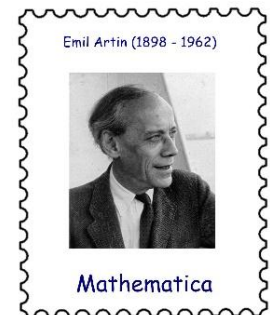
EMMY NOETHER was particularly influential on his future development, as she strongly supported the talented young scientist. This collaboration resulted in his first paper, which was published in the *Mathematische Annalen*.

Upon returning home, VAN DER WAERDEN completed his military service at the naval base in Den Helder and during his free time he wrote his dissertation *De algebraïese grondslagen der meetkunde van het aantal* (The Algebraic Foundations of the Geometry of Numbers), in which he refined HERMANN CAESAR HANNIBAL SCHUBERT's rather intuitive definitions and theorems on enumerative geometry and generally outlined the possible further development towards algebraic geometry. Incidentally, the doctoral regulations of the University of Amsterdam stipulated that the dissertation had to be written in Dutch or Latin and that it should contain only results without proofs.

At the suggestion of COURANT and NOETHER, VAN DER WAERDEN received a one-year *Rockefeller scholarship*, which enabled him to spend another semester in Göttingen and subsequently he studied with EMIL ARTIN in Hamburg.

The collaboration with ARTIN led to the idea of a jointly authored book, based on ARTIN's algebra lectures and the work of EMMY NOETHER.

However, when ARTIN saw VAN DER WAERDEN's early manuscripts, he ceded the entire work to him, and thus the famous *Modern Algebra*, a classic of algebraic literature, was born. The book was published in 1930 and was also translated into English, Russian, and Chinese, going through at least nine editions (later without the "Modern" subtitle).

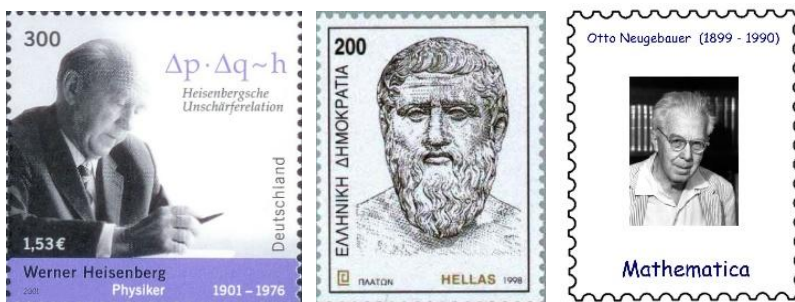


VAN DER WAERDEN qualified as a university lecturer at the University of Göttingen with the work "*The generalized theorem of BÉZOUT*" (This theorem states that two plane algebraic curves of degree m and n respectively intersect in the projective plane at exactly $m \cdot n$ points).

Following this, he became COURANT's assistant, when he focused particularly on topology.

In 1928, the 25-year-old simultaneously received offers of professorships at the universities of Rostock and Groningen, and he opted for a position in his home country. In 1929, he accepted a visiting professorship in Göttingen, where in July he met CAMILLA RELICH, sister of FRANZ RELICH, one of COURANT's doctoral students (later a lecturer in Marburg and a professor in Dresden).

VAN DER WAERDEN and CAMILLA RELICH married in September and the young couple then lived in Groningen. The happy marriage produced three children.



VAN DER WAERDEN accepted a professorship at the University of Leipzig, where he became a colleague of WERNER HEISENBERG and FRIEDRICH HUND. Their collaboration resulted in *Die gruppentheoretische Methode in der Quantenmechanik* (The Group-Theoretical Method in Quantum Mechanics) – a book that remains relevant today.

Another Leipzig colleague was the philosopher HANS-GEORG GADAMER, whose lecture on PLATO rekindled VAN DER WAERDEN's interest in the history of mathematics and the astronomy of antiquity – he had attended similar lectures during his studies in Groningen with his doctoral advisor HENDRIK DE VRIES and during his "apprenticeship in Göttingen" with OTTO NEUGEBAUER.

From 1934 onwards, VAN DER WAERDEN was a member of the editorial board of the *Mathematische Annalen*. When the pressure from the National Socialist authorities intensified to prevent the publication of contributions by Jewish authors, he was prepared to resign his position.

However, when he learned that the committed National Socialists WILHELM BLASCHKE or LUDWIG BIEBERBACH were intended as his successors, he decided to continue his work (he performed the task until 1968).

He was also pressured to renounce his Dutch citizenship, especially after the outbreak of the World War and the occupation of the Netherlands by German troops. His resistance against the *Gleichschaltung* (coordination) of the university's governing bodies was in vain.

As the bombing raids on Leipzig intensified, his house was destroyed, and all his documents, including his extensive correspondence, were lost. For a time, the family lived with VAN DER WAERDEN's brother-in-law in Dresden. He spent the last months of the war with his family at his mother-in-law's home in Graz (Austria).

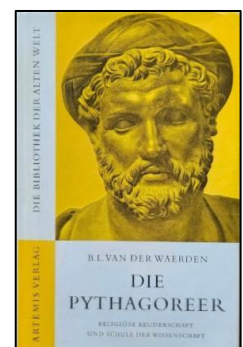
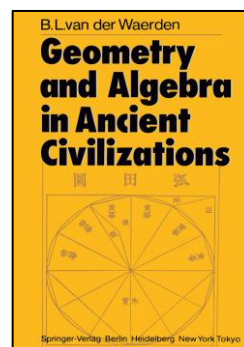
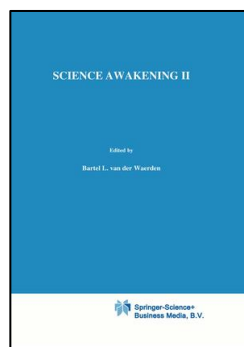
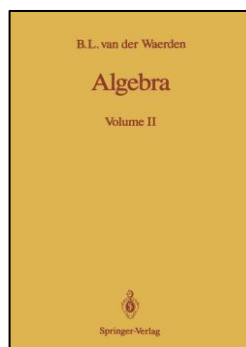
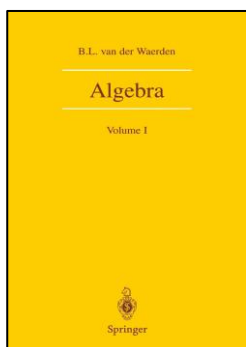
After the war ended, he was expelled from the country by the Allied authorities as a non-German and ordered to return to the Netherlands. In the meantime, his parents had died – his father from cancer, and his mother, in despair over her situation, had committed suicide.

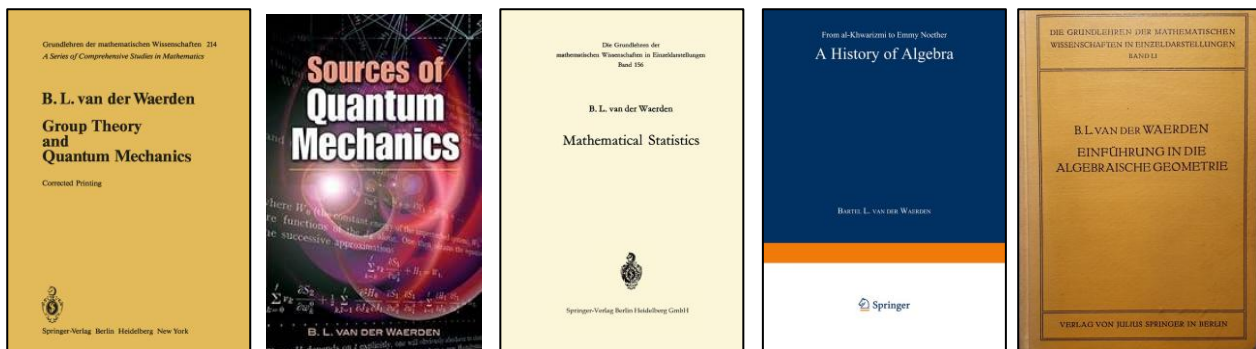
Initially, he found no opportunity to take up a professorship in his home country, as his long stay in Nazi Germany was held against him. HANS FREUDENTHAL eventually secured him a position at Shell in Amsterdam, where he worked on problems in applied mathematics.

In 1947, he accepted a visiting professorship at *Johns Hopkins University* (Baltimore), but declined an offer of a permanent position. In 1948, he returned to the Netherlands and taught at the University of Amsterdam. When the University of Zurich offered him a position as professor and director of the Mathematical Institute in 1951, he accepted and continued his wide-ranging lecturing and research activities.

He supervised more than 40 doctoral students and published numerous works, even after his retirement in 1973 – a total of 22 books and approximately 300 individual articles. He expanded his 1930 algebra book into two volumes, his application-oriented *Mathematical Statistics* (1973) went through several editions, including various translations, and his *Mathematics for Natural Scientists* (1975) achieved widespread distribution.

On history, he published: *Awakening Science – Egyptian, Babylonian and Greek Mathematics* (1956) – previously published as *Ontwakende wetenschap* (1950) and *Science Awakening* (1954). Further works include: *The Pythagoreans* (1979), *Geometry and Algebra in Ancient Civilizations* (1983), *History of Algebra* (1985), *The Astronomy of the Greeks* (1988), and others.





VAN DER WAERDEN received numerous honours for his services. At the ICM Congress in Nice (1970) he gave one of the main lectures (*The foundation of algebraic geometry from SEVERI to ANDRÉ WEIL*). A theorem from combinatorics also reminds us of him:

VAN DER WAERDEN's theorem: If the numbers $1, 2, \dots, N$ are coloured with r colours, then there exists an arithmetic progression of length ℓ in $\{1, 2, \dots, N\}$ which is coloured the same way.

Example: If you colour the numbers $1, 2, \dots, 9$ with two colours, you cannot prevent an arithmetic sequence of length $\ell = 3$ from being created.

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<https://mathematik-ist-schoen.jimdoweb.com/>

Translated by John O'Connor, University of St Andrews
