LEONARD EUGENE DICKSON

Leonard Eugene Dickson (January 22, 1874 – January 17, 1954) was a towering mathematician and inspiring teacher. He directed fifty-three doctoral dissertations, including those of 15 women. He wrote 270 papers and 18 books. His original research contributions made him a leading figure in the development of modern algebra, with significant contributions to number theory, finite linear groups, finite fields, and linear associative algebras.

Under the direction of Eliakim Moore, Dickson received the first doctorate in mathematics awarded by the University of Chicago (1896). Moore considered Dickson to be the most thoroughly prepared mathematics student he ever had. Dickson spent some time in Europe studying with Sophus Lie in Leipzig and Camille Jordan in Paris. Upon his return to the United States, he taught at the University of California in Berkeley. He had an appointment with the University of Texas in 1899, but at the urging of Moore in 1900 he accepted a professorship at the University of Chicago, where he stayed until 1939.

The most famous of Dickson's books are *Linear Groups with an Expansion of the Galois Field Theory* (1901) and his three-volume *History of the Theory of Numbers* (1919 – 1923). The former was hailed as a milestone in the development of modern algebra. The latter runs to some 1600 pages, presenting in minute detail, a nearly complete guide to the subject from Pythagoras (or before 500 BCE) to about 1915. It is still considered the standard reference for everything that happened in number theory during that period. It remains the only source where one can find information as to who did what in various number theory topics. The first volume covers the topics of divisibility and primality. The second is a comprehensive treatment of Diophantine analysis, and the third covers quadratic and other forms. Dickson's account is encyclopedic with voluminous references.

The work is a model of objectivity. He began the monumental work on the first page in Chapter 1 of the first volume with the definition of "aliquot divisors" of a number (the divisors, including one, that are less than the number), followed by the definition and an example, $1 + 2 + 3 = 6$, of a "perfect number." Dickson held number theory in the highest regard, it being a branch of mathematics where both professionals and amateurs have made significant contributions. In the preface, he says:

> "During twenty centuries the theory of numbers has been a favorite subject of research by leading mathematicians and thousands of amateurs. Recent investigations compare favorably with the older ones. Future discoveries will far surpass those of the past."

One famous number theory problem was known as *Waring's Conjecture*. In 1770, Edward Waring, Lucasian professor of mathematics at Cambridge University, guessed that every integer is the sum of a *fixed* number N of nth powers of integers, where n is any given positive integer and N depends only upon n. For $n = 2$, the required N is 4, for $n = 3$, the required N is 9; for $n = 4$, it is known that N is not larger than 21. As examples,

$$78 = 8^2 + 3^2 + 2^2 + 1^2 \text{ and } 23 = 2^3 + 2^3 + 1^3 + 1^3 + 1^3 + 1^3 + 1^3 + 1^3.$$

In 1909, David Hilbert proved that the conjecture was true but his "existence" proof did not indicate the number of nth powers required. Working independently, Dickson and S.S. Pillai put the problem to rest except for a few cases that were settled by Dickson's student I.M. Niven. Dickson, insisted on precision in the statement of theorems in number theory, and was renowned for his ability to detect and mend unsound arguments.

Number theory has long been considered to be the "purest" of mathematical fields in that it was believed by Dickson and others, such as G.H. Hardy, to be the least susceptible to practical application.

According to Howard W. Eves in *Return to Mathematical Circles* (1988), Dickson once observed at a meeting of the American Mathematical Society that, "It is a lucky thing that newspaper reporters do not attend these meetings. If they did they would see how little our activities are related to the real needs of society." He then illustrated his point by discussing his proof that every sufficiently large integer can be written as the sum of not 1140 tenth powers, as was previously believed, but 1046 tenth powers. Today number theory has many applications in the study of fractals, chaos theory, ciphers and artificial intelligence.

Dickson served as the president of the American Mathematical Society (AMS) in 1917-1918. He was the first recipient of the Cole Prize for algebra awarded in 1928 by the AMS for his book *Algebren und ihre Zahlentheorie* (Algebras and Their Arithmetics, 1927). Dickson was known for his corny puns such as "How does a piece of writing paper remind you of a lazy dog?" Answer: "A piece of writing paper is an ink-lined plane, and an inclined plane is a slope up, a slow pup is a lazy dog."

Quotation of the Day: "Thank God that number theory is unsullied by an application." – Leonard E. Dickson