

## KLEIN ON NINETEENTH CENTURY MATHEMATICS

*Vorlesungen über die Entwicklung der Mathematik im 19. Jahrhundert.*

By Felix Klein. Teil I. Berlin, Springer, 1926. xiii+385 pp.

Twenty years ago, during a series of walks in the forest about Hahnen-  
 klee, in the Hartz Mountains, the conversation between Klein and a com-  
 panion covered, as would naturally be the case, a wide range. Three state-  
 ments, however, impressed his listener\* very strongly. One was political:  
 "There was a time when we looked up to England socially, politically, and  
 as a naval power,—but that is a thing of the past." The second was political  
 and of military significance: "America has no standing army today;  
 twenty-five years hence she will have a large one." It is not strange that  
 his auditor wondered at the real significance of these two statements by  
 a man of Klein's vision and prominence. The third remark was in response  
 to a statement to the effect that he of all men was the one to write a history  
 of mathematics in the 19th century. "I am too old," was the reply, "It  
 needs a young man who could devote years to its preparation." When it  
 was urged that he had seen the development and had taken part in it as  
 few if any others living had done, he remarked, "No, all that I could do  
 would be to give a few lectures on the great events, but I am too much occu-  
 pied to prepare even these." Ten years later, when the war was on, and  
 his family had been sorely stricken, he gave these very lectures in his home  
 in Göttingen, before a small group of listeners anxious to receive from a  
 master that which only a master could give.

The lectures have been edited by Professors Courant and Neugebauer  
 and are published as Band XXIV of *Die Grundlehren der mathematischen  
 Wissenschaften*, a recent series, already well known to all mathematical  
 students. Rightly did they say in their Vorwort: "Diese Vorlesungen sind  
 die reife Frucht eines reichen Lebens inmitten der wissenschaftlichen  
 Ereignisse, der Ausdruck überlegener Weisheit und tiefen historischen  
 Sinnes, einer hohen menschlichen Kultur und einer meisterhaften Gestal-  
 tungskraft; sie werden sicherlich auf alle Mathematiker und Physiker und  
 weit über diesen Kreis hinaus eine grosse Wirkung ausüben."

The work is divided into eight chapters. The first naturally begins with  
 the founder of the modern German school of pure and applied mathematics,  
 —Gauss. It considers his work in the applied field with respect to astron-  
 omy, geodesy, and physics, the last in connection with A. von Humboldt  
 and Wilhelm Weber. In pure mathematics the attention is given chiefly  
 to the number theory, forms, and the function theory, with a succinct  
 statement as to the claim that Gauss is entitled to the award of priority

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\* The reader may suspect the identity of the "listener," who modestly  
 conceals it. The editors may state at least that the conversation was actual  
 and that this report is a first-hand report.

(THE EDITORS)

in the discovery of non-euclidean geometry, although not to priority of publication (pp. 57–60).

Chapter II relates to France and the Ecole Polytechnique in the first decade of the century. In this Klein pays high tribute to the work of men like Fourier, Cauchy, Poncelet, Monge, and Galois. Of Cauchy he speaks as one “*der sich mit seinen glänzenden Leistungen auf allen Gebieten der Mathematik fast neben Gauss stellen kann.*”

Chapter III concerns the founding of Crelle’s Journal and the rise of pure mathematics in Germany. In this period the names mentioned as most prominent are those of Abel, Jacobi, Moebius, Plücker, and Steiner.

Chapter IV considers the development of algebraic geometry by Moebius, Plücker, and Steiner, with reference to Lagrange, Chasles, Cayley, Sylvester, Salmon, Beltrami, and Clifford, as well as to his own countrymen,—Riemann, Hesse, and Grassmann.

Chapter V deals with mechanics and mathematical physics in Germany and England before 1880,—the period of Hamilton, Thomson (Kelvin), and Maxwell in England, of Gibbs in America, and of Franz Neumann in Germany.

Chapter VI is devoted to the development of the theory of functions of a complex variable, chiefly at the hands of Riemann and Weierstrass, but with mention of the influence of Dirichlet, H. A. Schwarz, Fuchs, C. Neumann, Kovalevski, and others.

Chapter VII is taken up with the study of algebraic forms, and Chapter VIII with that of the theory of groups and automorphic functions, with special reference to the work of Galois, C. Jordan, Hermite, Riemann, and Poincaré.

It is proposed, in Band II, to treat chiefly of the theory of invariants and of relativity.

All who knew Professor Klein with any degree of intimacy are aware of his broadmindedness and catholicity of spirit. His love for science did not permit him to allow political prejudices to warp his judgment as to the tribute due to scholarship beyond the boundaries of his own country. It speaks well for his judicial spirit to observe that, of the scientists mentioned, nearly half were not of German nationality. Nearly a fourth were French, about an eighth were British, and a fair number were from Italy, Scandinavia, Russia, and our own country. It was natural that the work of the Germans should have been best known to him, and it was entirely fair that he should have ranked them higher than others of the last half of the century, not alone numerically but on the score of achievement.

DAVID EUGENE SMITH