KLEIN'S COLLECTED WORKS

Felix Klein: Gesammelte mathematische Abhandlungen. Vol. 1. *Linien-geometrie, Grundlegung der Geometrie, Zum Erlanger Programm.* Edited by R. Fricke and A. Ostrowski. Berlin, Julius Springer, 1921. xiii + 612 pages.

Felix Klein, born at Düsseldorf, April 25, 1849, was awarded the doctor's degree December 12, 1868, by the University of Bonn. The dissertation was directed and the examination conducted by Professor Lipschitz. At the golden jubilee of the doctorate, celebrated at Göttingen, December 12, 1918, plans were perfected for the publication of the numerous and varied mathematical contributions he made during the ensuing fifty years.

This was a particularly fitting thing to do. During this time no one exercised a greater influence on the development of mathematics in Germany than he. That that influence was not confined to Germany is attested by the long list of Americans who have taken the doctorate under his direction, and the very large number who have come from all parts of the world to hear his lectures or to participate in his Seminar. Notwith-standing the excellence of his personal contributions, and the inspiration of personal contact with him, probably his strongest characteristic was his skill as an organizer, and his capacity for cooperation.

Klein is essentially a geometer, and he began his work just in the zenith of the teaching of Clebsch, Kummer, Plücker and von Staudt; a worthy member of the group which included Lie, Darboux, Cremona, Clifford, Noether . . . How important are their achievements in the study of the more critical concepts of number, integral, limit, point set, etc., of to-day!

Of the three sub-titles indicated, the memoirs on line geometry occupy the first 240 pages. While the text is nowhere materially changed, a few corrections are introduced, indicated by square brackets, a considerable number of comments so marked are found in the footnotes, and each longer memoir or group of related memoirs is prefaced by biographical material written by the author, which add not only to the human interest, but aid in the understanding of the relations between various questions considered.

While at Bonn, Klein was Plücker's assistant, not only in the preparation of lecture notes on theoretical physics, but also in the writing of the *Line Geometry*.* Klein intended to make physics his chief study, but acquired so much momentum in this work that he could not stop. At the time of Plücker's death the first part of the *Line Geometry* was practically all in print, but much of the second part was undeveloped. Plücker had started Klein on the problem of the quadratic complex, and the supervision of his progress was now taken over by Lipschitz. Plücker's treatment of the new idea was detailed and elementary, strikingly different from the style of Battaglini, who wrote on the quadratic complex shortly after Plücker's

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* *Neue Geometrie des Raumes, gegründet auf die Betrachtung der geraden Linie als Raumelement.* Part I, pp. 1–226, edited by Clebsch, 1868; Part II, pp. 227–378, edited by Klein, 1869.