

its magnitude, but of Clifford's in its large number of brief, pointed papers on topics of general mathematical interest.

The arrangement is by sets, the articles from any one serial appearing together in chronological order. The monograph on the theory of invariants of binary forms is at the close of volume 1, those on the solution of the quintic and sextic are scattered through all of these volumes. Each has a table of contents and a well-executed index. Volume 1 contains the well-known portrait, and the concluding (fifth) volume is to furnish a classified index and a compendious life.

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Verhandlungen des dritten internationalen Mathematiker-Kongresses in Heidelberg vom 8 bis 13 August, 1904. Herausgegeben von dem Schriftführer des Kongresses, DR. A. KRAZER. Leipzig, Teubner, 1905. Royal 8vo, x + 755 pages.

A CONGRESS that can attract four hundred members and hold them for a week, half of them coming from countries outside Germany, must show in its proceedings something worth the study of philosophers, still more that demands the attention of progressive mathematicians. Numbers count for little, but the names of the participants prove the representative and international character of this great gathering. It is gratifying to see Russia occupying second place in number of delegates, and our own country contesting with Denmark the fifth place.

The secretary's report contains the address of Professor Weber, of Strassburg, in opening the Congress, which, it will be remembered, was designed in part as a commemoration of the centenary of the birth of C. G. J. Jacobi. Then follows the address of Professor Königsberger on Jacobi's life and work — dignified, scholarly, full of particulars, but free from technicalities, in short the finished production of the one man who was qualified by his biographical studies and oratorical ability for this onerous task. Next come the four lectures delivered in the general sessions, and these will doubtless prove, for most readers, the most profitable part of this voluminous record. Their titles are as follows: P. Painlevé, "The modern problem of integration of differential equations"; A. G. Greenhill, "The mathematical theory of the top, considered historically"; C. Segre, "The geometry of the present day and its

connections with analysis"; W. Wirtinger, "Riemann's lectures upon the hypergeometric series and their significance." Of these the first and third belong to that rare and valuable class of mathematical literature which appears in some prefaces and in a few biographies, precise in statement, artistic in diction and style, broadly comprehensive, yet vividly suggestive. The others attain nearly the same degree of interest, Professor Greenhill's by its graphic mingling of experiment with theory, and Professor Wirtinger's by its lucid exposition of rich material preserved in a shorthand report of Riemann's lectures, and now brought to light after more than forty years of oblivion. After reading this and recalling the few similar events now classic, one may venture to expect that some day yet the missing manuscripts of Jacobi, alluded to by Königsberger, may be recovered.

The titles of the papers read before the six sections, nearly eighty in number, were given in the BULLETIN a year ago,* together with many abstracts and summaries. Most of them will appeal to large circles of readers; it may be permissible to mention one in particular that is universally interesting, that of Professor F. Meyer, of Königsberg, on the essential nature of mathematical proof. That there is no real increase of mathematical knowledge has been affirmed by others, but certainly not often reinforced by such a convincing series of far-reaching analyses: to the principal thesis the eloquent closing paragraph may be found to supply the needful antithesis.

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NOTES.

THE April number (volume 7, number 2) of the *Transactions of the AMERICAN MATHEMATICAL SOCIETY* contains the following papers: "On geometries in which circles are the shortest lines," by C. E. STROMQUIST; "A generalization of the notion of angle," by G. A. BLISS; "The square root and relations of order," by O. VEULEN; "The problem of partial geodesic representation," by E. KASNER; "On the pentadeltoïd," by R. P. STEPHENS; "The groups of order p^n which contain exactly p cyclic subgroups of order p^a " by G. A. MILLER; "Groups in which a large number of operators may

* Vol. 11 (1905), pp. 205-217, and 247-263.