



Review

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many temperaments will bring to life what may seem at first but dry bones. In the case of loci it is quite possible that the full significance of the results may not be grasped without a geometrical investigation. But it is to the last six chapters of the book that teachers will look with the most interest. No text-book gives us such a survey of homogeneous coordinates and their applications. After carefully studying the five-and-thirty pages devoted to areals as the simplest system of homogeneous coordinates, the student is well equipped for the study of those coordinates in general. Trilinears fall into their natural place and no longer hold in our text-books the somewhat illogical position that they have been allowed to assume in the past. The sections on cross ratios, harmonic section and involution are followed by a chapter on invariants, which is excellent in every detail. Tangential equations and envelopes fill another twenty pages, and the final sections of the book form a model chapter on covariants. We must not omit to draw attention to such sections as 300 (a), which indicates the care to be exercised in dealing with the line at infinity. These betray the practised teacher who is fully aware of the pitfalls that await the average pupil. The splendid collection of examples contains a large number of Scholarship, College, and Tripos questions, and in many cases suggestive hints are given which will be found of value in the individual problem and in those of the same or similar type. In spite of the full table of contents it seems to us, considering the novelty of treatment and the character of the last few chapters, that the author will do well in a future edition to add an index. The pleasure of glancing again and again through Dr. Askwith's pages somewhat atones for its absence, but that feeling does not prevent us from pointing out the inconvenience to those who want to find things in a hurry. No volume on Analytical Geometry can yet avoid a direct challenge of comparison with the great classic of the subject. But the young enthusiast who is touched by the mathematical spirit, and the teacher whose views on methodology are in a state of flux, are not to be pitied as long as they have on their shelves copies of Salmon, Fiedler-Salmon, Scott, and Askwith.

Practical Curve Tracing, with Chapters on Differentiation and Integration. By R. H. DUNCAN. Pp. vii+137. 5s. net. 1910. (Longmans, Green.)

Mr. Duncan's new contribution to the literature of Curve Tracing is intended primarily for the student who has the minimum of equipment of the "mental gymnastic" type of mathematics. The ninth page opens with the discussion of the simple equation of the first degree, and $y = ax + b$ (the relation between x and y being described as "the straight line law") is illustrated by six figures, three arising from the varying of a while b remains constant, and the rest from the variation of b while a remains constant. The line that is drawn as evenly as possible between the various points plotted out is termed the "mean straight line," and the use of a stretched thread is recommended as more satisfactory for practical purposes than that of the set square or ruler. The reader is naturally interested to see how this same method works out when applied to members of the parabolic family. After carefully studying chapters iv.-vi. we cannot help feeling that Mr. Duncan's proposals are pedagogically sound, and we have more than a suspicion that the student who has mastered these chapters will have acquired a more thorough and more permanent grasp of what the term "parameter" implies than he can get, at any rate so rapidly, in any other way. The next two chapters are given up respectively to the exponential family and to the sine curves, simple, compound, and damped. Half a dozen pages suffice for the graphic solution of equations, and the rest of the 116 pages deal with "The slope of a curve—Differentiation" and "The Area of a Curve—Integration." The small collection of examples provided is ample for the author's purpose, and at the end of the book the necessary tables are appended. The only proof of the pudding is of course in the eating. It would be interesting to hear from such of our readers as may be tempted to give Mr. Duncan's methods a trial what their experience of the result may be. Bearing in mind that his book is written for those who are weak in "purely academic Mathematics" there is ample opportunity throughout the book of abbreviating the steps. In many cases, no doubt, the pupil's own resources may be equal to the task, especially if he knows he is invited to suggest "improvements."

Practical Arithmetic for Schools. By W. G. BORCHARDT. Pp. viii + 445 + lxxvi. 3s. 6d.; with Answers 4s. 6d. Part I. 2s.; with Answers 2s. 6d. Part II. same prices. Examples, separately, with or without Answers, 3s.; or Part I. 1s. 6d., Part II. 2s. each, with or without Answers. 1909. (Rivingtons.)

After using for a term Mr. Borchardt's contribution to the already considerable number of text-books on the market, we have come to the conclusion that every teacher should possess a copy whether he is able to introduce it into his classes or not. Having said so much, it would seem to be unnecessary to say any more about its merits.

Savants du Jour. Henri Poincaré; Gaston Darboux. By E. LEBON. Pp. viii + 80 and pp. viii + 72. 1909-1910. 7 fcs. each. (Gauthier-Villars.)

That there are certain disadvantages inherent in biographies of living persons is obvious enough, and yet it is well that the world should know something of its greatest men while they are yet with them. The man in the street has his needs in this respect amply catered for by paragraphs in the daily press or by magazine articles. But this is not sufficient for those who are themselves interested professionally or otherwise in the particular work that is the preoccupation of the object of their admiration, or of those who are endeavouring humbly to follow in his footsteps. To M. Lebon is due the excellent idea that is embodied in the series called *Savants du Jour*, the two first numbers of which lie before us. It is a far cry from the pemmican that is offered by "Who's Who" to the mass of sometimes quite irrelevant matter which is to be found in the ordinary biography. Neither is entirely satisfactory to the student or to the worker in the same field as the expert as to whose labours information is required. Hence the *raison d'être* of these monographs, which we owe to the energy and enthusiasm of M. Lebon. He assumes that the particular class for which he is providing is desirous to know the nature and the scope of the researches already accomplished by an individual, their relation to work done in the same field or fields by others, and, if possible, what is thought by other experts of the value of the work achieved. And if this is accompanied by an analytic bibliography this class is content. Now this is exactly what M. Lebon does, and gives us in each instance an admirable heliogravure in addition. In the case of the first monograph, which naturally is devoted to M. Henri Poincaré, the purely biographical part is supplied by the historian Frederic Masson, whose duty it was to pronounce the usual panegyric upon the leader of the French scientific world on the day when he became one of the famous "forty." Herein are felicitously sketched the salient features of the career of the subject of this memoir, with a literary skill which is only rivalled in the admirable criticism and analysis of Poincaré's *Science et Méthode* by Emile Faguet, another famous Academician. Of Poincaré's work in Mathematical Physics and in Pure Mathematics we have an excellent summary in the reports presented by M. Gustave Rados to the Hungarian Academy of Science on the occasion of the award of the Bolyai prize. Here is deftly sketched the winner's work in the theory of functions, in Analysis Situs, and in the theory of numbers. At the same time the relation of his labours to those of Cauchy, Lie, Hermite and others is lucidly indicated. As for Poincaré's achievements in the realm of celestial mechanics, we are proud to see that Prof. Sir G. H. Darwin has been selected to give his testimony to the great merits of the famous Frenchman. In the speech delivered* when Poincaré was presented with the gold medal of our Royal Astronomical Society, Sir George Darwin had an opportunity, of which he was not slow to avail himself, of alluding to the "revelation" afforded by the researches of the subject of this monograph in celestial mechanics. After each of these addresses we find a careful bibliography set out under suitable headings—a most convenient arrangement for ready reference to the work of so many-sided a man. The sum total of memoirs, articles, official reports, orations, prefaces,—nothing seems forgotten—amounts to 436 items.

The second volume of the series is devoted to M. Gaston Darboux, and is carried out on parallel lines to those of its predecessor. Perhaps the name

* The date on p. 37 should be 1900. It is correctly given on p. 40.