

It may be noticed that W. K. Clifford arrived at these results in precisely the same way (*Proceedings of the London Mathematical Society*, vol. 7, p. 29), and when he found that he had been anticipated by Darboux, expressed his opinion that this, viz: the work of Darboux that we are now considering, is a book which it is almost inexcusable in a geometer not to have read, marked, learned and inwardly digested.

There are many other interesting investigations in the book, especially a study at considerable length of the intersection of a sphere with a cyclide; an extension also of Ivory's theorem to confocal cyclides is worthy of notice. If A, B, C are three points on the cyclide and A', B', C' are three corresponding points on a confocal cyclide, M. Darboux shows that the relation

$$AB' \cdot BC' \cdot CB' = BA' \cdot CB' \cdot BC'$$

connects the distances between the points.

R. A. ROBERTS.

BESSEL FUNCTIONS.

A Treatise on Bessel Functions and their Applications to Physics.

By ANDREW GRAY and G. B. MATHEWS. Macmillan & Co. 1895. 8vo, x+292 pp.

The transcendental functions to which Bessel's name has been attached are not only of the highest importance in mathematical physics, second perhaps only to the trigonometric and exponential functions, they are also of great interest to the student of pure mathematics both from the formal side and from the point of view of the theory of functions. There has, however, up to this time been no connected treatment of these functions in the English language, with the exception of the utterly inadequate treatment contained in the last sixty-five pages of Todhunter's book, *The Functions of Laplace, Lamé and Bessel*, published twenty years ago. The German monographs by C. Neumann and Lommel make no attempt to cover more than small portions of the subject, and the same is true to an even greater extent of the sections devoted to Bessel's functions in Heine's *Kugelfunctionen*, Basset's *Hydrodynamics*, Rayleigh's *Sound* and elsewhere. Messrs. Gray and Mathews have therefore filled a real gap in mathematical literature.

The authors make it clear in their preface that their own