

## DARBOUX'S PRINCIPLES OF GEOMETRY.

*Principes de Géométrie Analytique.* By GASTON DARBOUX.  
Paris, Gauthier-Villars, 1917.

A MONTH before his death Darboux wrote the préfacé to this, his last treatise. It presents in coordinated form lectures which he had delivered at intervals since 1872 either at the Sorbonne or the Ecole Normale. In the preface he announces that "the essential object of the book is the precise development of the notions relative to the imaginary and to infinity, and to show that in geometry they have the same place and importance as has been attributed to them in analysis for a long time." This idea is one which had very strong hold on Darboux's mind during his whole life. We find evidences of it in his first treatise, *Sur une Classe remarquable de Courbes et de Surfaces algébriques et sur la Théorie des Imaginaires*, published in 1872, which deals largely with material presented in better form in part of the present volume. He touched upon the idea in his address before the Fourth International Congress at Rome in 1908. Moreover, the results of his own researches, in which isotropic elements are so effectively used, bear fitting testimony to the force of his contention.

The treatise consists of five books, or parts. The first has an introductory chapter dealing briefly with the history of the development of the ideas of infinity and imaginary elements, and an indication of the value of these entities and of homogeneous coordinates. Darboux remarks that the moderns differ from the ancients in their aim to reduce geometrical problems to general principles. His own efforts along this line in the field of differential geometry were rewarded with results which constitute one of his chief glories. The next three chapters deal respectively with tetrahedral coordinates, homographic point transformations, anharmonic ratio, abridged notation of Bobillier and plane homologies. The treatment is essentially the same as is to be found in other developments of these ideas from the analytic point of view. It is necessary to treat these ideas fully, since the treatise is intended for students who have had merely an introductory course in cartesian analytical geometry of two dimensions. Similar characterization may be given the next three chapters,