Mélanges de Géométrie à Quatre Dimensions. Par E. JOUFFRET. Paris, Gauthier-Villars, 1906. 227 pp.

IN the preface to this work the author expresses its purpose as follows: "Dans l'avant-propos de notre traité élémentaire de géométrie à quatre dimensions (page xviii), nous avons avancé que les théories classiques peuvent trouver d'utiles inspirations dans ce quatrième champ que nous avons appellé l'étendue, monde géométrique plus vaste que le leur, où des droites, des plans et des espaces sont déterminés respectivement par deux, trois, et quatre points, et sont coupés par un espace suivant des points, des droites, et des plans. Nous nous proposons de donner maintenant quelques applications de nature à justifier cette proposition."

The book contains eight chapters bearing the following titles: Coup d'œil sur les principes de la géometrie à quatre dimensions; Le système de coordonnées et les trois premiers polyèdres réguliers; L'hexagramme de Pascal; La surface du troisième degré; L'hexagramme et l'hexastigme; Les hypersurfaces du second degré; Les quartiques; Là question de l'existence réelle de l'hyperespace. Few errata have been noted by the reviewer, and generally they are of such a nature as not to occasion any difficulty. A curious oversight occurs on page 8, line 4, where each of the equations $x_1 = 0$, $x_2 = 0$, $x_3 = 0$, $x_4 = 0$, $x_5 = 0$ is spoken of as defining a plane. On the preceding page it is expressly stated that, in the geometry of four dimensions, a plane is defined by two linear relations among the variables. Each chapter closes with a brief summary giving in a concise form the results that have been obtained. In chapters involving many details these summaries are very useful. In Chapter VIII arguments are drawn from various sources in support of the existence of hyperspace. The author states that these are given because they are of interest, although the question does not enter in the field of mathematics. All that the author desires is simply to establish the utility of the idea.

One might be tempted to criticize the book on the ground of lack of unity. The author first devotes his attention to a discussion of the system of coordinates in the geometry of four dimensions; he then inserts two chapters, one dealing with a problem in the plane and the other dealing with a problem in space, before he comes back to the four dimensional geometry.

However, he has chosen a title for his book which permits considerable freedom both as to the matter presented and as to the order of presentation.

PETER FIELD.

Neuere Darstellungen der Grundprobleme der reinen Mathematik im Bereiche der Mittelschule. By ALOIS LANNER. Berlin, Otto Salle, 1907. viii + 192 pp. Price, 3 Marks.

ONE of the distinctive features of the teaching of elementary mathematics in the latter part of the nineteenth century was the influx of a large body of new theory relating to the fundamental laws underlying the common processes. Perhaps the best evidence of this is found in the lectures of Weierstrass, and among the best exponents of the movement is Stolz's "Allgemeine Arithmetik." It was natural to expect, however, that Weierstrass would never directly reach the teaching body of Germany, and that works as elaborate as those of Stolz would have but little practical influence in the schools.

The opening of the twentieth century is seeing an effort to bring the results of such labors as these to the attention of those who teach the elements. Naturally this involves a great deal of experiment. The college professor, with little knowledge of the powers and interests and immediate needs of preparatory students, is liable to insist upon secure foundations for every process, while the teacher in the classroom is equally likely to err the other way. For those who try to see the argument of each of these types, and to weigh them judicially, any effort to simplify the labors of the theorists and to present them in concise form, is very welcome.

Dr. Lanner has attempted exactly the work. He has not written a textbook, nor a work on the theory of teaching, but he has prepared a simple treatise that seeks to supplement each. In brief, it may be described as a handbook, giving in simple form the principles underlying each of the chapters of arithmetic and algebra as taken up in the elementary courses, and offering material for supplementing the theory of the textbook.

The general nature of the work can best be judged by a few of the chapter heads: Gleicheit und Grösse; Die natürlichen Zahlen, followed by the various operations; Erweiterung des Zahlengebietes durch die Subtraktion, introducing negative numbers; Die Teilbarkeit der ganzen Zahlen, both absolute