

parallels that of the second. Now the map space of linear point ranges is an  $R_7$ , the Segre manifold is quartic and four-dimensional, and properties of quartic curves and surfaces follow by considering the singular ranges in pencils and bundles. Here, as in the preceding chapters, the author studies the collineations of the map space which leave fixed the corresponding Segre manifold. By noting that quadric hypersurfaces in  $R_7$  are the maps of linear complexes, the author leads naturally to the principle of triality of Study and Cartan, null systems, the line sphere transformation, and properties of oriented spheres.

The final chapter deals with trilinear forms and some applications to the preceding situations as well as to non-euclidean geometry.

The author has succeeded in bringing together a large variety of geometrical configurations and studying them in a way which will stimulate the student's interest and arouse his admiration for geometrical methods.

HARRY LEVY

*Mathematical Recreations and Essays*. 11th edition. By W. W. Rouse Ball. Revised by H. S. M. Coxeter. New York, Macmillan, 1939. 16+418 pp.

For almost half a century the earlier editions of this book<sup>1</sup> have provided a rich supply of mathematical topics commonly known as recreations, which although they often involve fundamental mathematical methods and notions, yet make their appeal in the spirit of a game or a puzzle, rather than with an eye to the usefulness of their conclusions. Since no knowledge of the calculus or of analytic geometry is presupposed, many of these recreations make excellent subjects for student talks in undergraduate mathematics clubs.

The eleventh edition, revised by H. M. S. Coxeter after Ball's death, not only "aims to preserve the spirit of Ball's delightful book," but does. It is, nonetheless, a thorough-going revision of the tenth edition. The chapters on Mechanical Recreations, Bees and their Cells, and String Figures have been omitted. In their stead we find the following material.

(1) A large new section of arithmetical recreations (chap. II), in-

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<sup>1</sup> Editions of this book have also appeared in French and Italian. A three-volume edition in French with considerable additional material, especially in the history of numbers, was edited by J. Fitz-Patrick in Paris (1907-1909), and a new edition appeared in 1926-1927 with new material by A. Margossian, Reinhart, J. Fitz-Patrick and A. Aubry. Two Italian editions were printed in Bologna, the first in 1911 by D. Gambioli, 398 pp., and the second in 1927 by D. Gabioli and G. Loria.