matics of relativity. A fifth chapter, on functions of a very large number of variables, and areas and volumes in a geometry of 10^{24} dimensions, leads up to statistical mechanics, the number stated being of the order of magnitude of the number of molecules in the unit volume, or the number of dimensions of their velocity space.

The titles of the seven papers forming the second part are as follows: On the principles of the kinetic gas theory; statistical mechanics and irreversibility; the relativity of space according to Henri Poincaré; some remarks on the theory of resonators; on a problem in geometric probability; the kinematics of the theory of relativity; molecular theories and mathematics.

These investigations of some of the most modern questions in theoretical physics should prove of great interest to both mathematicians and physicists.

T. H. GRONWALL.

Grundzüge der Geodäsie. Von M. NÄBAUER. Leipzig, Teubner, 1915. xiv+420 pp.

THIS book forms volume 3 of Handbuch der angewandten Mathematik, edited by H. E. Timerding, and is written primarily with the purpose of acquainting students of mathematics with the modern methods of geodesy. This purpose is quite successfully accomplished by presenting just enough of the practical side of the subject to give the proper setting for the clear and terse mathematical discussion of the underlying principles and the sources of error in the various geodetic operations.

The first part contains the theory of errors and the application of the method of least squares to the reduction of observations. Part two, plane surveying, deals with the surveying instruments, the various kinds of field work (the paragraph on photogrammetry is especially well done), plotting and computation of areas. Part three, higher geodesy, begins with triangulation and the various kinds of coordinates on the earth considered as a sphere, proceeds to the earth ellipsoid, its conformal representation on the sphere and the determination of its dimensions, and ends with a brief account of the determination of the exact figure of the earth by astronomical and pendulum observations.

The mathematical apparatus is confined to the elements of the calculus, and the volume contains much that could be used

to advantage in bringing a course in trigonometry in closer touch with one of its main applications.

T. H. GRONWALL.

Relativity. By A. W. CONWAY. Edinburgh Mathematical Tracts, number 3. London, G. Bell and Sons, 1915. 2 s. 43 pp.

THIS tract is a course of four lectures delivered before the Edinburgh Mathematical Colloquium on the subject of relativity. The audience were representative of various branches of science. These four lectures start with fundamentals, followed by a study of the transformation of the electromagnetic equations, applications to radiation and electron theory, and Minkowski's transformation. The lecturer has succeeded very well in presenting the essentials of the relativity hypothesis free from metaphysics, and speculations of any kind. He has a decidedly sane treatment. There are examples enough to make the ideas clear, stated in everyday terms, and not in terms of the usual mathematical model. It is a serviceable introduction.

JAMES BYRNIE SHAW.

A Theory of Time and Space. By ALFRED A. ROBB. Cambridge, University Press, 1914. vi + 373 pp.

THIS treatise is an elaboration of a previous publication on the same subject. In brief it is an analysis of space and time relations by means of a single type of order called conical. The author also calls the result optical geometry. The treatment is of an axiomatic character, the few diagrams serving only as schemes. There are twenty-one postulates set down, and from these and various definitions, some two hundred and six theorems are deduced. These ultimately lead to statements which permit an algebraic formulation by the use of four parameters, which may be interpreted as the usual x, y, z, and t, the last having a somewhat different rôle from the others. The notion of relativity of course hovers in the background, but any one seeking light on that notion here will be disappointed, as the book is simply a development of a very abstract geometry of four dimensions.

It is not possible to give a resumé of the contents in a review, but some idea can be gained of the point of view by stating