various journals and thereby to lose sight of the relationships that they have to one another. The volumes constitute a major contribution to our knowledge of an important part of the world and will add to the basic facts of world zoogeography, ecology, evolution, and other sciences. Congratulations to the two national research centers for sponsoring this basic biology and best wishes to the editors for their continued success.

NEAL A. WEBER
Department of Biology,
Swarthmore College

Estuarine and Coastal Waters

Tidal Computations in Rivers and Coastal Waters. J. J. Dronkers. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. xii + 518 pp. Illus. $17.50.

Few hydraulic engineers are as well qualified as Dronkers to compile a book on tides and tidal computations. The experience that he and his countrymen have gained in the Netherlands, first, in closing the Zuider Zee, and currently, in executing the vast Delta Project, is reflected throughout the book.

Dronkers selects as his task the presentation of the mathematical and physical fundamentals of tidal theory together with a comprehensive, up-to-date discussion of various techniques for computing flow rates and water stages in estuaries and coastal waters. A brief introductory chapter precedes the four major parts of the book. Part 1 (2 chapters) is devoted to the study of tide-generating factors and to the harmonic analysis of tides. In this part both Darwin's method and Doodson's method for determining tidal constituents are given in detail. A presentation of basic hydrodynamics and hydraulics is given in the four chapters that constitute part 2. A review of the mathematics and dynamics of fluid motion and the hydrodynamics of open-channel flow precedes discussion of the phenomenon of liquid wave motion and wave classification. Particular emphasis is rightly placed on the characteristics of long waves since tidal waves are long waves. In chapter 7 a complete and detailed derivation of the general partial differential equations of long wave motion in shallow water is presented. The effects of surface wind stresses, Coriolis acceleration, as well as the frictional forces arising from rigid channel boundaries are fully treated and included in the derivation. In part 3 Dronkers presents a very thorough discussion of the three principal techniques for limited solution of the derived equations of motion. Chapter 8 is devoted to the harmonic method of solution in which, once the nonlinear terms in the equations have been linearized, Fourier series is introduced to determine the tidal properties. The difficult problems of linearization of the flow-resistance term is treated empirically as well as by using Chebyshev polynomials. The next two chapters are devoted to discussions of solutions by the method of characteristics and by finite-difference procedures, respectively. Chapters 11 and 12, the fourth and final part, are devoted to the representation of various field situations by use of the mathematical, tidal-flow model. A variety of special applications are presented.

Dronkers unquestionably succeeds in providing his readers with a thorough, logically organized survey of current work on tidal computations, something not previously available in one volume. However, I noted a few deficiencies and faults. The derived partial differential equations represent homogeneous fluid motion. More specifically, they represent liquid motion not subject to density variation caused by saline intrusion. In fact, with but one exception (p. 189), the author avoids discussion of mathematical representations which treat nonhomogeneous estuarine waters. Moreover, despite the stress he places on the impact that the high-speed, digital computer has had on tidal computations in the past decade, Dronkers does little to illustrate or otherwise substantiate this statement of fact. None of the organizational procedures essential to having a particular solution method executed by a digital computer are mentioned in either parts 3 or 4. Although I noted some typographical errors, most of them are only nuisances. Despite an occasional awkward sentence (perhaps due to translation problems) and a tendency to be overly methodical, Dronkers' book is entirely readable and a truly worthwhile reference. Its value is further enhanced by inclusion of an up-to-date and comprehensive bibliography.

ROBERT A. BALTZER
Surface Water Research Section,
Water Resources Division,
U.S. Geological Survey

Definitions, Formulas, Tables

The Universal Encyclopedia of Mathematics. With a foreword by James R. Newman. Simon and Schuster, New York, 1964. 715 pp. Illus. $8.95.

This elementary, popular encyclopedia ranges in level from high school mathematics through most of the usual college calculus. Some more advanced topics are included—for example, complex numbers but not group theory or topology. There are numerous interesting items in addition to the conventional classroom topics.

Where appropriate, the style is intuitive and informal, rather than mathematically rigorous. Thus, under the heading of infinitesimal calculus, limiting processes are described in a manner that conveys a generally correct impression without giving technical details. Fairly detailed treatments are given for such major topics as analytical geometry, calculating instruments and machines, conic sections, determinants, logarithms, and trigonometry. Diagrams are judiciously employed for purposes of illustration and clarification.

In the main part (almost 500 pages), subjects are discussed under alphabetical headings: Binary System, Combinatory Analysis, Euler's Theorem on Polyhedra, Interest, Probability, and Vector, to mention but a few. Some of the items receive too brief a mention. In particular, in discussing duplication of the cube and trisection of an angle, it would be well to detail the classical restrictions (unmarked ruler, what the compass can do), so that the assertions of impossibility will be both precise and justified.

The alphabetical section of the encyclopedia precedes more than 100 pages of formulas, classified under arithmetic, algebra, applications, geometry and trigonometry, analytical geometry, special functions, series and expansions in series, differential calculus, and integral calculus. Finally, there are more than 100 pages of tables. The formulas and tables enhance the book's value to students and other practicers of mathematics.

In addition to using this book as a reference work, students and nonmathematicians with mathematical interests may enjoy browsing in it.

S. S. CAIRNS
Department of Mathematics,
University of Illinois