by this means the necessity for a knowledge of right ascension, sidereal time, the first point of Aries, or the equation of time is automatically eliminated.

The section on meteorology has been contributed by Dr. Sverre Petterssen, an international authority on the air mass theory.

It is a matter of opinion whether all the examples of the methods advocated are ideally chosen, and the present writer is not impressed with the nature of the star chart in the folder. Nevertheless, the book can be recommended with confidence to the aviator, navigator, or exploratory surveyor alike.

G. C. F.

Theory and Practice of the Calculus

The Elements of Mathematical Analysis
By J. H. Michell and M. H. Belz. Vol. 1. Pp. xxiv + 516. Vol. 2. Pp. xii + 517–1087. (London: Macmillan and Co., Ltd., 1937.) 42*s*. net each vol.

THE authors have set themselves the task of writing a treatise on the differential and integral calculus which should be at once practical and rigorous, while assuming only the minimum of previous mathematical knowledge. The emphasis, however, is on the practical side, the book being, to quote the dust-cover, "adapted to the particular needs of students of science and engineering".

A fairly full account of the elementary theory of functions of one real variable is given, though not enough to cover the requirements of an honours degree in mathematics. Where an appeal must be made to an unproved theorem—for example, concerning differentiation of $f\{x, y(x)\}$ — the reader's attention is directed to the fact; and, where possible, the theorem is made to appear plausible by being proved or verified in some special case. A good feature is that in several places a strict mathematical treatment is followed by a paragraph entitled "Working Notions", in which the student is shown how loose intuitive ideas suggest or recall the result.

The presentation of the theory is, in the main, well suited to the class of students for which the treatise is intended. For example, in the main body of the work the idea of the non-terminating decimal is taken as fundamental (the Cantor theory of numbers being explained in a final chapter). This introduces very naturally the method of continued decimal subdivision to prove the fundamental theorems. One might wish, however, that this important method were rather more fully explained. Continuous functions are introduced at an early stage, and the limit of a function is dealt with by means of the easily grasped idea of potential continuity. On the other hand, the "general principle of convergence" is derived from a general discussion of limit-processes, which appears to the reviewer to be too abstract and difficult. Taylor's theorem is very well treated, losing that air of mystery which too often surrounds it. Integration is defined as the inverse of differentiation, the Riemann integral being introduced, but discussed only for a continuous integrand. Curvature, length, area and volume are dealt with rigorously but comprehensibly.

Mathematical rigour in language is usually maintained, but in one place we have "finite" for "bounded", while there seems to be a slight slip in the proof of the limit-sum integral formula. There are a few departures from standard terminology, some of which, such as the distinction between "upper barrier" and "upper bound", are good; while others, for example, "upper continuity" (for continuity on the right), seem likely to lead to confusion.

The practical side of the book is good. There are many worked examples and a large collection of problems. Maxima and minima, interpolation, Newton's method for solving an equation, and other applications of the derivative and of Taylor's theorem are thoroughly dealt with. The trigonometric, exponential and hyperbolic functions are discussed at length and used as examples of methods previously explained, while the expocyclic and epicene functions also are introduced. There is a long section on the standard forms of integrand (with recurrence formulæ), and approximate methods of integration are not neglected. Special emphasis is laid on the calculation of the uncertainty in approximations. There is a section on curves, and one on polynomial approximation by various methods. Finally, we have an introduction to differential equations, the second order equation with constant coefficients being completely discussed. It is perhaps a pity, from the practical point of view, that the authors here keep strictly to the domain of the real variable.

To sum up, the book may be recommended to all those who wish to know something of the mathematical discipline of function-theory, but whose main concern with mathematics is as a tool.

A. J. WARD.