the idea that the value of the function becomes *and remains* less than any assigned number were accentuated.

The section on gradients and rates of change might have been improved by less reference to the graphs and more to arithmetical substitutions, such as is given on p. 365, but carried further by using the values 1·01, 1·001, 1·0001, etc., and this without any reference to a graph.

Integration is defined as the inverse of differentiation, and the "area under a graph" is deduced from this definition. The variety and quality of the examples on this section are again praiseworthy.

But with all its good points, one closes this book with an unsatisfied desire for a more solid meal, unless one keeps in view the standpoint of the authors—capacity to apply results in later work: and then the appendix—for which indeed the authors apologise—might have been omitted. Their plea—which practically amounts to a call for the correct education of examiners—is recommended to the notice of all those who set such questions as the authors condemn.

J. M. CHILD.

Advanced Calculus: a text upon select parts of Differential Calculus, Differential Equations, Integral Calculus, Theory of Functions, with numerous exercises. By EDWIN BIDWELL WILSON, Ph.D., Professor of Mathematics in the Massachusetts Institute of Technology. Pp. ix + 566. 5 $. Ginn & Co.

Amid the torrent of works on the Calculus and Analysis which is continually issuing from the Press, it is a pleasure to distinguish those of marked individuality. Most of the books that appear deal mainly or solely with the elementary parts of the subject: Professor Wilson, on the other hand, passes rapidly over the elements—more, indeed, by way of review than of detailed exposition—and centres his attention on the further development of the theory, and, in particular, on its applications.

The work begins with the definition of the differential coefficient, and leads on to simple and multiple integrals, ordinary and partial differential equations, the calculus of variations, trigonometric series, the functions of Legendre and Bessel, conformal representation, and elliptic functions. There is some differential geometry, some theory of convergence, and some vector analysis.

The programme is a long one, and the attempt to perform it in less than 600 pages is ambitious. But one's sympathy is with the man who makes the attempt; for there is no doubt that the study of mathematics to-day is suffering from excessive prolixity of treatment in the text-books. Look, for instance, at one of the latest Introductions to Algebraical Geometry—a piece of work so admirably done in many respects that one hesitates to say a word in disparagement; and yet what colossal waste to devote over 500 large pages, crowded with examples, to nothing but the equations of the first and second degrees!

There are many different ways of pruning a subject in order to bring it within a reasonable compass. The one that finds favour on the Continent (perhaps in a review of an American work, it should be explained, that the European continent is meant) is to do without examples. In spite of the continuity, and in some cases the charm, that results from this method, our countrymen have generally rejected it; and I am disposed to agree with them. For a student cannot attain to a sound understanding of a theory in any better way than by applying it to examples.

Another method is to lop off all the higher part, and present the lower elements in their full tedium. This is the common practice of the lesser sort of English text-book writers. An attempt is sometimes made to justify it in the preface, on the ground that the book is thereby made easy: a statement that can often be met by a simple denial.

The third method, which I believe to be in most cases the right one, and which is followed here by Professor Wilson, is to restrict the text proper to the leading propositions in the subject. The question then arises as to what should be done with the less important propositions of the bookwork; some writers convert them into examples, which increases the usefulness of the book for reference, but makes the student shy of attempting examples when he is going through the work for the first time; others drop them altogether, and give only easy examples springing directly from the main propositions: and this is perhaps in most cases the best way of all. Professor Wilson's idea as expressed in his preface seems to be that of steering a middle course between the two alternatives: but, while giving him the credit to which he is entitled for the provision of many easy riders, I think that his practice has tended decidedly towards including an immense number of what are really well-known theorems and potted memoirs proposed as examples. There is indeed a strong incentive to do this: an author who knows and loves his subject finds it hard to banish altogether a result that appeals to him; and, knowing that its relation to the direct line of theory scarcely warrants a place of honour in the text, he puts it in small type as an example. I have often done this myself, and Professor Wilson has done it most liberally. The result is that his book is a rich mine of miscellaneous material, something in the style of the work of the late Dr. Routh. Not that this is any disparagement: for I will say candidly that if I had to choose a limited number of mathematical volumes for a prolonged stay on a desert island, I should put Routh's works high on the list: open them where you will, there is always something for the mind to dwell on. I fancy that this tendency in book-making is found especially among those writers who, like Dr. Routh and Professor Wilson, comprise both Pure and Applied Mathematics within their range.

The limits of a short review forbid any attempt at description in detail of the successive chapters of the work. Suffice it to say that the author knows what he is writing about, and has produced a solid and excellent book. One may perhaps be disposed to feel that his frequent changes of subject are sometimes rather abrupt, and that many of his jewels have very little setting: but this could hardly have been avoided in a work containing so much material in so restricted a compass.

A word of praise must be given for the courageous way in which Professor Wilson sweeps aside difficult and (from the practical point of view) useless analytical criteria, *e.g.* for discriminating between maxima and minima in the differential calculus and the calculus of variations. Many an author has made an otherwise interesting book almost unreadable by inserting such things as these; and frequently the motive has been nothing but fear of the mathematical Mrs. Grundy, who declares that there is a "want of rigour" or "want of completeness," if they are omitted.

Among minor points, we may notice that Professor Wilson writes "Bessel's functions" and "Bessel functions" indifferently, and thereby avoids committing himself on a vexed question. The purists would have rejected such terms as "Bessel functions," "Pullman cars," and "Röntgen rays," and even such compounds as "telegraph wires" and "railway stations." They will, however, find it difficult to persuade mathematicians to reject "volume integrals" in favour of "voluminous integrals"; and on the whole one cannot but recognise that the simpler custom has come to stay. About this there need be no regret: for the addition of another element of flexibility is no real detriment to the English language.

E. T. WHITTAKER.

Junior Practical Arithmetic. By W. G. BORCHARDT. Pp. 256+xliii. 2s. 1913. (Rivingtons.)

This is an excellent little text for Junior Forms in Schools. The exercises are, where possible, for the most part of a problem nature, and therefore interesting. There is added a large collection of Test Papers, which might be used for homework.

Junior Course of Arithmetic. By H. SYDNEY JONES, M.A. With Answers. 224 pp. Price 1s. 6d. (Macmillans.)

This is a little volume of exercises selected from Part I. of the Author's *Modern Arithmetic*, "prepared to meet the needs of schools in which the price of books is an important consideration." It can be recommended to those who are on the look out for a Lower Form text.

J. M. C.

Die Lehre von den Kettenbrüchen. Von Dr. OSKAR PERRON, Professor der Mathematik an der Universität Tübingen. Pp. 520. 20 marks. 1913. (Teubner.)

In writing his work on Continued Fractions, Dr. Oskar Perron has filled a gap in mathematical literature at a place where for some time a work has been needed.