For students taking a rigorous course the book discusses series in the setting of complex numbers and develops the exponential and trigonometric functions as sums of complex power series. Use of certain ideas (e.g. the number π) is scrupulously avoided until they have been formally presented in the text. The theory of metric spaces is treated in considerable detail in Chapter 3 with discussions of uniform convergence and the Stone-Weierstrass and Ascoli theorems. A novel idea is the introduction in Chapter 6 of the Lebesgue integral as a first integral on the real line.

For the mathematically mature the book contains a host of interesting results, historical references and exercises. The author says in his preface that he spent at least three times as much effort in preparing the exercises as he did on the main text. As a result there are hundreds of eye-catching exercises, many with subdivisions and hints. Some are routine, some lead up to a main result (e.g. that the number e is transcendental), some bear twentieth century surnames, some offer alternative methods, some introduce and illustrate concepts not dealt with in the main text (e.g. Fourier transforms, Lagrange multipliers, Bernoulli numbers, Lambert series). The exercises of the last three chapters on Integration, Infinite series and products and Trigonometric series are particularly impressive.

The production, printing and layout of the book are all pleasant and misprints seem to be few. Spare a thought though for F. Mertens (J. Reine Angew. Math. **79** (1875)), who is in danger of losing his s: in referring to his result on multiplication of series this book is common with at least three others sets the apostrophe after the *n* and before the *s*.

Students of Analysis will find the book inspiring but may also find it somewhat inhospitable in places: a case in point is the definition of continuity, another is the treatment of radius of convergence and the examples on it. Nevertheless the overall impression is of a fine achievement which will have appeal for analysts everywhere.

IAN S. MURPHY

ATIYAH, M. F. et al, *Representation Theory of Lie Groups* (L.M.S. Lecture Note Series No. 34, C.U.P., 1980). £10.95.

A research symposium was held in Oxford in 1977 and this book consists of the notes of eleven of the lectures given there. There are two parts. The first contains general and introductory lectures and the second more specialised lectures.

Although there are now many excellent texts on Lie groups, the general lectures in the present book are very valuable. They give brief accounts of several aspects of the theory. Someone who wants to find out about a particular aspect of the theory may well prefer to look here first rather than in one of the voluminous texts on the subject.

The lectures in the second part are somewhat more advanced but nevertheless they are quite accessible to non-specialists. Indeed someone who wants to see how Lie groups are used in a particular application may well find what he wants in one of these 'more specialised' lectures.

Undoubtedly there are many mathematicans who are aware that Lie groups are somehow relevant to the kinds of mathematics that interest them. A quick look at this book may well enable them to find out what the connection is and serve as a useful introduction to the literature. The book is not the specialised proceedings of a research symposium that one might expect before opening it.

ELMER REES

SCHWARZENBERGER, R. L. E. *N-dimensional crystallography* (Pitman, Research Notes in Mathematics No. 41, 1980), £6.50.

These notes are largely based on undergraduate lectures given by the author at the University of Warwick. However it contains a lot of material that could be used in courses at a higher level; in particular it could serve as a basis for some interdisciplinary seminars between mathematicians, physicists and chemists. There are many books on this topic written by chemists and physicists but there seem to be only a few written by mathematicians. This book should help mathematicians to bridge the (largely notational) gulf between themselves and others who handle the same basic material on crystallography rather differently.

Throughout the book the material is treated in a fairly geometric way but quite a lot of linear algebra, elementary group theory and topology is used. Students who attended this course saw some down to earth questions answered using techniques that they had probably seen in a more abstract format earlier in their courses. Their knowledge of some basic material (linear algebra etc.) would be both consolidated and further motivated by this course. Personally, I feel that more of our final year mathematics courses should 'round off' earlier courses in the way that this course did.

The first chapter discusses groups of motion of the plane. Almost everything that is done later in the book is done in this chapter for the special case of the plane.

The second chapter introduces the language that is used throughout the book and studies affine groups acting on $\mathbb{R}^n$. The importance of the subgroup of translations is stressed and short exact sequences are consistently used to describe the relationship between a group, its translation subgroup and its quotient group. This chapter also has a careful explanation of the equivalence used between two affine groups. This important but slightly subtle point has often been omitted in the 'applied' texts, indeed different equivalences have sometimes been used as if they were the same—leading to mistakes.

Space groups are treated in the third chapter. There is a topological as well as an algebraic discussion. To me the most fascinating elementary aspect of the study of space groups is the crystallographic restriction; in most books this is done for $\mathbb{R}^2$ and $\mathbb{R}^3$. Here it is done for $\mathbb{R}^n$ but the theorem stated only applies if the action of the group is irreducible (however the reviewer must admit that in a course a few years ago he also 'proved' the theorem as stated in this book). There is a correct version but is slightly complicated to state.

The next three chapters give a full, detailed account of the classification of n-dimensional space groups for low values of n and also a discussion of the classification programme for large n.

The final chapter discusses deformations; this topic does not usually make an appearance in books on crystallography. The author makes a convincing case for its inclusion. Most of the material in this chapter has been developed by the author himself.

The book ends with a very interesting historical and bibliographical note. This is particularly valuable in a book that treats material, some of which is quite old and much of it on the border of several subjects.

The book is produced from typescript but it is quite easy to read and has relatively few misprints. It suffers a little by not having an index; the discussion sometimes relies on a precise definition and it would be useful to be able to find the exact definition quickly. My overall impression is that lecturers contemplating giving a final year university course of a geometrical nature and hoping to consolidate some of the concepts that the students have already met would find a lot of useful material in this book. Nevertheless they would probably think that a course devoted to crystallography would be too specialised and would include some other material as well.

I enjoyed reading a book at a reasonably low level containing new material.

ELMER REES

DOLLARD, J. D. and FRIEDMAN, C. N. *Product integration with applications to differential equations* (Encyclopedia of mathematics and its applications, Volume 10, Addison-Wesley, 1979) xxii+253 pp., U.S. $24.50.

The simplest case of the product integral

$$\prod_a^b e^{A(s)ds}$$

occurs when A is a square matrix-valued function whose elements are continuous on $[a, b]$. If $P(s_0, s_1, \ldots, s_n)$ is a partition of $[a, b]$ and A_P a step-function on P (i.e. one taking constant matrix values $A_1, A_2, \ldots, A_n$ on the subintervals of P), the product integral of A_P over $[a, b]$ is