

## SHORTER NOTICES

*The Bakhshālī Manuscript—A Study in Mediaeval Mathematics.* By G. R. Kaye. With photographic facsimiles of the manuscript and transliteration of the text in roman script. Calcutta, Government of India, Central Publication Branch, 1927. Pp. i+156+v. Plates 1+4+42. Price Rs 28 or 43s. 6d.

Bakhshālī is the name of a village near the city of Peshawar in the north-west corner of India. There in 1881, a farmer unearthed a manuscript of a work on mathematics. The greater portion of it has been destroyed by rough handling and the remains consist of 70 leaves of birch-bark but some of these are mere scraps. That manuscript is now generally known as the Bakhshālī Manuscript. It is preserved in the Bodleian Library, Oxford. The work of analysing and editing the Manuscript was begun by the distinguished Indologist, Dr. R. Hoernle, but on account of his untimely death, it came to the hands of Mr. G. R. Kaye who has successfully finished it. The editor has added an elaborate and masterly introduction to the text covering 84 pages in print which contains not only an analysis of the contents of the manuscript but also a study of its relation with other Hindu treatises of mathematics as far as possible.

The Bakhshālī work is a compendium of rules and illustrative examples. It gives also the solutions of the most of the examples together with their verification. It contains material relating to arithmetic, algebra, and geometry (including mensuration). The topics for discussion are found to include fractions, square-root, arithmetical and geometrical progressions, income and expenditure, profit and loss, computation of gold, interest, rule of three, summation of certain complex series, simple equations, simultaneous linear equations, quadratic equations, indeterminate equations of the second degree of a particular type, mensuration and miscellaneous problems. The treatment of all these subjects is commonly included in other Hindu treatises of mathematics. But we miss in it any reference to the treatment of the indeterminate equation of the first degree and the so-called Pellian equation, both of which enter largely into later Hindu works and in the solution of which the Hindus long anticipated the works of Euler and Lagrange.

The most notable mathematical principles in the Bakhshālī work are the approximate square-root formula,

$$(a^2 + r)^{1/2} = a + \frac{r}{2a} - \frac{(r/(2a))^2}{2(a+r/(2a))},$$

the calculation of the errors of successive order

$$\epsilon_1 = (r/(2a))^2, \quad \epsilon_2 = \left( \frac{(r/(2a))^2}{2(a+r/(2a))} \right)^2$$

and a consequent process of reconciliation. The fundamental arithmetical