

A FIRST BOOK OF ALGEBRA

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A First Book of Algebra by John W. Hopkins & P. H. Underwood

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JOHN W. HOPKINS & P. H. UNDERWOOD

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A FIRST BOOK OF ALGEBRA

BY

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"As regards the method of teaching algebra, I would make it, in the earlier stages, as much a generalized arithmetic as possible. Results obtained by algebra would be verified by arithmetical instances; and the use of a formula would be indicated as including any number of instances. Elaborate (and to my mind wearisome) processes, useful for solving artificial combinations of difficulties, would be at least deferred. With a comparative beginner, progress towards new ideas or new stages of old ideas can, I think, best be made by the simplest instances, and it is on this account that I would build algebra entirely on arithmetical foundations so far as concerns the teaching of beginners."

— *Professor Forsyth, M.A., D.Sc., F.R.S., Cambridge.*

"It is assumed that pupils will be required throughout the course to solve numerous problems which involve putting questions into equations. Some of these problems should be chosen from mensuration, from physics, and from commercial life. The use of graphical methods and illustrations, particularly in connection with the solution of equations, is also expected."

— *Extract from the Report of the American
Mathematical Society, 1903.*

PREFACE

THIS book aims to introduce the young student to the study of algebra; in particular to those portions of algebra which are indispensable in the study of geometry, mensuration, physics, and chemistry as pursued in secondary schools. It is an outgrowth of class-room experience, lays stress on fundamental principles, and illustrates those principles so that the beginner may not "regard algebra as a very arbitrary affair, involving the application of a number of fanciful rules to the letters of the alphabet."

As far as the authors know, this is the first beginners' book that graphically illustrates the fundamental rules, fundamental laws and facts, and incidentally brings out in bold relief the essential connection between arithmetic, algebra, and concrete geometry. Whoever wishes to obtain a clear and sound knowledge of the fundamental operations of algebra must have recourse to arithmetic and geometric illustrations, for learning is at bottom largely a process of visualizing.

Every point which we have found to give trouble to the young learner is dealt with in a way to bring into play the perceptive powers of the student. Professor

Minchin well says: "Effective teaching requires a great deal more than a bare recitation of facts, even if these are duly set forth in logical order. The probable difficulties which the intelligent student will naturally and necessarily raise to some statement of fact or theory, — these things our authors seldom or never notice, and yet a recognition and anticipation of them by the author would be often of priceless value to the student." Few of our pupils in secondary schools have a clear conception of why it is that like signs in multiplication of two numbers produce a plus result. Here is one instance where a text-book should come to the assistance of the student.

The idea of graphically representing fundamental laws and facts was suggested to one of the authors by the lectures of Professor Bolza upon the functions of a complex variable. For several years he has attempted to carry out this idea in his own teaching, and now he gives it in concrete form in this book.

We have endeavored to make the subject of algebra seem real. As we have followed in the footsteps of one of the most brilliant lecturers on mathematics, we have some confidence that the theoretical development is both pedagogically and scientifically sound. From actual classroom work we know that it appeals to students.

The examples in this book are easy. Hard and dull examples are omitted. We give a large number of problems, and a very considerable percentage of these is modern. In the typical solutions we aim to be natural. Short cuts and ingenious devices are nowhere introduced.