THE FIRST STEPS IN ALGEBRA

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The First Steps in Algebra by G. A. Wentworth

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G. A. WENTWORTH

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FIRST STEPS IN ALGEBRA

BY

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PREFACE.

This book is written for pupils in the upper grades of grammar schools and the lower grades in high schools. The introduction of the simple elements of Algebra into these grades will, it is thought, so stimulate the mental activity of the pupils that they will make considerable progress in Algebra without detriment to their progress in Arithmetic, even if no more time is allowed for the two studies than is usually given to Arithmetic alone.

The first chapter prepares the way for quite a full treatment of simple integral equations with one unknown number. In the first two chapters only *positive* numbers are involved, and the beginner is led to see the practical advantages of Algebra before he encounters the difficulties of negative numbers.

The third chapter contains a simple explanation of negative numbers. The recognition of the facts that the real nature of subtraction is counting backwards, and that the real nature of multiplication is forming the product from the multiplicand precisely as the multiplier is formed from unity, makes an easy road to the laws of addition and subtraction of algebraic numbers, and to the law of signs in multiplication and division. All the principles and rules are enforced by numerous examples involving *simple* algebraic expressions only.

The ordinary processes with *compound* expressions, including simple cases of resolution into factors, and the treatment of fractions, naturally follow the third chapter.

A chapter on fractional equations with one unknown number, a chapter on simultaneous equations with two unknown numbers, and a chapter on quadratics follow in order. Only one method of elimination is given in simultaneous equations and one method of completing the square in quadratics. In each of these three chapters a considerable number of problems is given to *state* and solve. By this means the learner is led to exercise his reasoning faculty, and to realize that the methods of Algebra require a strictly logical process.

The course may end with the chapter on quadratics, but the simple questions of arithmetical and geometrical progression are so interesting in themselves and show so clearly the power of Algebra that it will be a great loss not to take the short chapters on these subjects.

It is expected that the chapter on square and cube roots will spare the pupils the necessity of committing to memory the long and tedious rules given in Arithmetic.

A short chapter on graphs has been introduced. This subject should prove of great value in stimulating the imagination of the pupils and in presenting to them the subject of equations from a new point of view.

The last chapter contains many examples by subjects. These examples may serve as a review of the whole book, or may be used as a supplement to the chapters when the pupils study them for the first time.

Nearly all the examples throughout the book are new, and made expressly for beginners.

Any corrections or suggestions will be thankfully received by the author.

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CHAPTER I.

INTRODUCTION.

NOTE. The principal definitions are put at the beginning of the book for convenient reference. They are not to be committed to memory. It is a good plan to have definitions and explanations read aloud in the class, and to encourage pupils to make comments upon them, and ask questions about them.

1. Algebra. Algebra, like Arithmetic, treats of numbers.

2. Units. In counting separate objects or in measuring magnitudes, the *standards* by which we count or measure are called **units.**

Thus, in counting the boys in a school, the unit is a boy; in selling eggs by the dozen, the unit is a dozen eggs; in selling bricks by the thousand, the unit is a thousand bricks; in measuring short distances, the unit is an inch, a foot, or a yard; in measuring long distances, the unit is a rod or a mile.

3. Numbers. *Repetitions of the unit* are expressed by numbers.

4. Quantities. A number of specified units of any kind is called a quantity; as, 4 pounds, 5 oranges.

5. Number-Symbols in Arithmetic. Arithmetic employs the arbitrary symbols, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, called **figures,** to represent numbers.