

**FIRST BOOK IN
ARITHMETIC: INCLUDING
ORAL AND WRITTEN
EXERCISES, PP. 14-168**

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First Book in Arithmetic: Including Oral and Written Exercises, pp. 14-168 by Daniel W. Fish

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DANIEL W. FISH

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Robinson's *Shorter Course.*

° FIRST BOOK

ARITHMETIC,

INCLUDING

ORAL AND WRITTEN EXERCISES.

By DANIEL W. FISH, A.M.,

EDITOR OF ROBINSON'S SERIES OF PROGRESSIVE ARITHMETICS.



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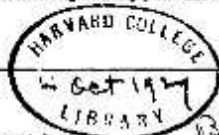
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PREFACE

ARITHMETIC has been defined as "the science of numbers, and the art of computing by means of them." It embraces,

1st. The mode of representing numbers by figures and signs, in accordance with an accepted system ;

2d. The principles and methods of their combination in addition, subtraction, multiplication, and division ; and,

3d. The application of these principles and methods to the solution of practical problems.

Primary Arithmetic can do little more than put the pupil in possession of the *alphabet* of numbers, and make him familiar with the various tables, securing readiness and accuracy in their use, and neatness and skill in written exercises upon them.

In this book, the object has been to secure this end by easy, gradual, and rational steps, and in such a familiar manner, as to avoid the drudgery of memorizing the abstract tables, and at the same time inspire intelligent thought in regard to the more simple processes that involve the use of numbers.

The plan of this book is *unique*, and it is believed that it will supply a want long felt by primary-school teachers. The natural and orderly *development of the subject*, the systematic *arrangement*, the copious *illustrative exercises*, and the provision for exhaustive *drill exercises*, cannot fail to meet the views of the most thorough and exacting teacher, and, at the same time, interest and attract the pupil.

The first seventeen lessons are intended to present the numbers from *one to ten*, inclusive, as *numbers*, in such manner that each of them shall be intelligently apprehended, not merely as a name, but as an *IDEA*—what it is, how it is represented, and what is its value relative to each of the others.

Succeeding this are familiar illustrations of the *use of signs*; and a series of easy and progressive exercises present the various combinations that can be made by means of any two of all the numbers under 12—giving practical drill exercises on the tables, and illustrating their use by means of problems.

A new form of table, "*equal parts of numbers*," has been introduced and practically applied, consistent with primary operations upon whole numbers, naturally deduced from the multiplication table as is the ordinary table of division. The practical value of this will be apparent from the problems and examples given in illustration, and the drill exercises in connection with it.

The exercises in notation and numeration are simple and progressive, and may be further extended, at the option of the teacher.

The latter part of the book makes a more thorough, but still progressive and systematic, presentation of principles and methods in the fundamental rules, oral and written.

The simple exercises here presented in Fractions and Measures (Denominate Tables) will furnish opportunity for more extended exercises, such as the judicious teacher may desire, or the requirements of particular classes may demand.

The *Pictorial Illustrations*, designed more for use than ornament, will commend themselves to the taste and judgment of discriminating teachers.

In the preparation of this book, the author has kept constantly in view such a systematic arrangement and development of principles and methods as to present the subject in the most natural as well as the most comprehensive manner.

The author desires to make special acknowledgment of the valuable services rendered in the plan, arrangement, and compilation of this book, by James Cruikshank, LL. D., a gentleman well known to the educational world, whose large experience for a number of years as Superintendent of the Primary Schools of the city of Brooklyn have made him familiar with the needs of teachers of this grade of schools.

With a desire to contribute to the facilities for elementary instruction, this little work is confidently submitted to the public.

D. W. F.

BROOKLYN, April, 1873.

HINTS TO TEACHERS

THE division of this book into *lessons* is not at all intended to mark out the limit of the *daily exercises*. Each lesson discusses a separate topic, and many of them furnish or suggest matter upon which several days may be profitably spent. Some of them present drill exercises that may be frequently repeated with profit—returning to them from more advanced periods. Practically, the exercises embraced in this book cover three years or more of the primary school course as prescribed in most of our *city schools*.

Advance *slowly*; one step at a time, and always secure a perfect mastery of any principle or operation upon which another depends, before proceeding to the next.

Go over only so much ground at any one exercise as may be thoroughly understood, and *review* daily.

The greatest source of embarrassment to the teacher, and of disgust and waning interest on the part of the pupil, is found in the accumulation of imperfectly mastered lessons.

Endeavor to secure the interest of the class, and never do for a pupil what he can be readily led to do for himself. *State exercises* are important *from the first*, and if judiciously conducted can never fail to please and instruct.

The various combinations by addition, subtraction, multiplication, and division, presented in the tables, furnish the instruments for all arithmetical operations. If the pupil is skillful in these, the only other thing needful is such a familiar knowledge of the *relation of things* as to know what process should be used in the solution of problems.

In the early lessons in arithmetic, the judicious teacher will observe that the introduction of numbers and of the successive digits representing them should be gradual. Examples should at first contain only 1's and 2's; then 1's, 2's, and 3's, until the pupil can add rapidly and correctly in whatever order they are combined.

Then introduce 4's with the preceding, etc. This remark applies also to subtraction, multiplication, etc. In all cases where there is hesitation or forgetfulness, return to special drill, in series, to master the particular number upon which the fault occurs.

The fundamental idea in all numerical combinations is found in *counting in series*. If each step as outlined in this book is mastered as indicated, progress will be easy and rapid, and the result most satisfactory.

Thus, in counting by 6's, the following give all possible additions of 6 with the *units* of any other number:

$0+6+6$; $1+6+6$; $2+6+6$; $3+6+6$; $4+6+6$; $5+6+6$; $6+6+6$.

Counting back gives all possible subtractions of 6. Multiplication and division, through the limit of each table are involved in counting by 6's to 72; as, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, and similarly for other tables. Observe carefully the models under the several lessons.

At each step, as the pupil becomes familiar with the formal operation of summing the series, he should be led to observe and state *how many times* the recurring number has been used; thus, 6, 12, 18 ($6+6+6$); there are 3 sixes in 18, or 3 times 6 are 18, etc.

Little real progress can be made even in memorizing until the name of each of the digits becomes to the pupil an intelligible *sign* of the number for which it stands. Thus, the figure 5, or the name *five*, should, upon being seen or heard, as clearly recall the idea of 5 units, singly, and together, as any common word brings up to the mind the idea which it represents.

Care should be taken that the *eye*, as well as the ear, be addressed and cultivated. Skillful oral repetition of the tables does not necessarily produce rapid and correct results, when the pupil has need to perform operations silently. This is an important consideration, inasmuch as the practical use of arithmetic is not *oral*, but *mental*, and the eye and the hand, rather than the ear and the tongue, become the instruments.

BLACKBOARD DRILL.—The blackboard should be a constant accessory in school-room instruction. A few among the many methods which should be used from time to time are suggested:

1. An exercise having been written upon the board, let a pupil, as called upon, go through the exercise as rapidly as is consistent

with accuracy, pupils or teacher indicating errors in such a way as may be deemed expedient. Generally the pupil should be required to *correct* the error himself, when attention is called to it. Another may then take up the work, and so on.

2. Proceed as before, except that each pupil in turn should name *one* step or result, and any error being made, the next should correct it, or, failing to do so, any member of the class may raise his hand, and make the correction. No blunder should be allowed to pass unnoticed.

It is generally advisable that each class exercise illustrated upon the board be also made a *slate exercise* for silent work.

3. When a little familiarity with any class of exercises is secured, the pupils should be encouraged to do the work upon the black-board themselves, without the intervention of the teacher.

4. From the very first no carelessness or slovenliness in making figures, or in the general form of the written exercises should ever, under any pretense, be allowed. Time spent in securing neatness will be regained tenfold in the pupils' subsequent progress, and in the culture in which it will result. This remark applies also to slate exercises. All slate exercises should be carefully examined, and the errors pointed out, and then corrected by the pupil.

Primary arithmetic does not involve any complicated processes of analysis or of reasoning. It deals chiefly with facts, and considers only the simplest and most evident relations of things. It is, therefore, recommended that *formal* analyses be used but sparingly. Those given upon pages 41, 45, 46, and elsewhere, are only suggestive, and after the process (that is, the *nature* of the operation) in any given case is understood, they may be discontinued, or varied, or used only occasionally. They are *not* in themselves an *end*, but only a *means* of determining the operation to be performed.

It is recommended that wherever *problems* are introduced, the *relations of the things* to which they refer be carefully explained, and then the *relations of the numbers* will be readily understood.

The attention of the pupils may be called to the several steps by judicious questions, and they may also be encouraged to *make problems* suited to numbers given in any case; as, given 5×4 ; we may say, "What is the cost of 4 yards of tape at 5 cents a yard?" etc.