

**KEY TO LEONARD'S
ARITHMETIC: FOR
TEACHERS ONLY**

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Key to Leonard's Arithmetic: For Teachers Only by George Leonard

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GEORGE LEONARD

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By GEORGE LEONARD, Jr.

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PREFACE.

THE following Key to Leonard's Arithmetic has been prepared for those teachers, who desire to have a proper method for the solution of each example at hand, at all times, for inspection. The sale of the Arithmetic has become large, and a Key has been repeatedly and urgently called for ; not from any uncommon abstruseness in the subjects and examples, but from a wish to become acquainted with the minutest steps of each process, approved by the Author. Especially in those subjects where much of the matter bears but a distant resemblance to that found in other books on similar topics. The Mechanical Powers, Specific Gravity, Gauging, Insurance, General Average, Discount, Equation of Payments, Mensuration, &c., are articles of this kind. Indeed, a considerable part of the Arithmetic differs materially from any other ; for the subjects which relate to business, are adapted to business as it is now done, and a large portion of the examples are such as really occur in actual life. Whereas, in other arithmetics the examples, as well as the rules, are nearly all compiled from old books ; so that a person who has studied one, has, in a measure, studied all, since they are all derived from the same sources. Who can possibly derive any idea of the operations required in practical affairs, at the present time, from the study of such antiquated rules and questions ; many of which were imaginary in their origin ?

A Key is doubtless more requisite for this book than for others, in which the teacher has merely to pursue the old beaten road. It is not pretended, however, that the manner of

working pursued here is in every case, the best that can be imagined, or gives the result with the smallest number of figures. But I have endeavoured to calculate by good methods ; methods which conform to the rules ; which are fitted for the transaction of business ; which can be understood, and by which the answer is obtained by means of a moderate number of figures. It should be kept in mind, that a course which in one example yields the answer with little labor, may be very tedious when applied to other questions, even if they are similar, and under the same rule. In fact, the trouble of finding such a course may be greater than the labor required in working with a larger number of figures by a more obvious method. Besides, we are liable to mistakes of various kinds, when much of the process is performed in the mind, or when one operation is made to cancel another. Many of the regular steps being then obliterated, the work cannot be fully understood by others, or even by ourselves.

The scholar should not be required to proceed in each sum in the same manner that is pursued here ; it is sufficient if he obtains the true answer by a correct method, though it be more difficult than the one in the Key. Should his course be quite long and tedious, it may then, indeed, be well to require him to seek a more ready method, and perhaps lead him to one by appropriate questions. But in no case should he be told fully and precisely in what manner he should perform an example. Questions that will induce him to think, and lead him, by his own reasoning to short and simple solutions, are proper, but positive directions should rarely be given.

Speaking of the impolicy of telling a scholar every step to be taken, reminds me of the propriety of saying a few words concerning the great number of rules and precepts to be found in many arithmetics. In these books every subject contains at least one rule, although the examples may involve the same principles as those under a general rule, by which they may be solved.

Now what does a scholar learn when there is such a multitude of rules. He merely learns to decipher the meaning of each one, and to take every step required by it in working the examples which

follow ; nothing more. When there is a rule for every thing, the reasoning faculties of the learner, so far as any useful exercise is concerned, are left at rest ; the author thinks for him, and really solves the examples for him ; he has nothing to do but go through the operations pointed out in the rules.

The scholar cannot remember these rules for any length of time. He cannot carry his arithmetic about in his pocket, to consult, in every question that arises in business. He is not exercised in applying common sense to discover the arithmetical operations proper to employ in each case. In fact, he is not taught to refer all ordinary calculations to a few simple, easily remembered principles ; the only course which can be of use to him in after life.

Persons who have pursued arithmetic in this way, hardly ever attempt to work in practice as they have been taught. They forget most of the immense mass of rules in a few months after leaving school ; and the questions that occur in business, they solve by common sense ; as well as a lack of all previous exercise in such a course will admit.

Another error, quite opposite the one I am now censuring, consists in dispensing with rules almost entirely. This course is not so injurious to the mind as the other ; but it is very tedious to refer back to first principles in all cases. The teacher, who has constant exercise, may be able to do so with sufficient facility. The apt scholar may also be ready enough while he is constantly engaged in this study, but in practical life he soon loses this facility, and forgets the half-perceived principles which have influenced him in many calculations. Indefinite ideas, or ideas that we have not learned to express or generalize in a sentence, soon pass from the mind.

From the preceding considerations it is obvious, that there should be but a moderate number of general rules ; the truth and propriety of which the scholar can be readily taught to understand and appreciate. These few rules can be remembered, and they serve as resting points to the mind. A person, by investigating each example in his book, and discovering the principles involved,

and the rules which apply, soon acquires an aptitude in this exercise; with an acuteness of perception that will enable him to overcome any difficulty that may arise in the many novel cases that constantly occur.

Another point in the Arithmetic connected with the Key, is worthy of discussion. Some teachers are anxious, that the answers should appear in the Key only, and should not be given in the Arithmetic, while a great majority prefer to have them constantly before the learner. There are, undoubtedly, both advantages and disadvantages in having the answers given. The greatest and almost only objection to answers in the Arithmetic, arises from the student's abuse of the information. In Addition, Subtraction, Division, Decimal Fractions, and in a few questions in some other subjects, the scholar can employ the answer to relieve him of much of his labor, unless he is counteracted. This difficulty can be obviated, in these rules, by having many examples worked on the black-board during recitation. Also, by occasionally requiring the class to close their books, and giving out questions to be solved on the slates. The last course excites each scholar's emulation to exceed his fellows in correctness and despatch. It should frequently be resorted to on this account alone.

In most of the rules the answers furnish no hint of the method of solution, and are rather beneficial than injurious, especially when extensive use is made of the black-board.

In conclusion, it may be well to observe, that this Key, being intended for teachers only, is published in a peculiar manner, in order to keep it out of the scholar's hands. It can be obtained only by a teacher, who applies personally to the publishers, or who sends them a *written* order by some bookseller or other person with whom they are acquainted.

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