PRACTICAL ARITHMETIC: AN INTRODUCTION TO ELEMENTARY MATHEMATICS FOR SCHOLARS BETWEEN THE AGES OF 9 AND 12

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649082131

Practical arithmetic: an introduction to elementary mathematics for scholars between the ages of 9 and 12 by A. Consterdine & S. O. Andrew

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

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PRACTICAL ARITHMETIC

BOOK I

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AN INTRODUCTION TO ELEMENTARY MATHEMATICS FOR SCHOLARS BETWEEN THE AGES OF 9 AND 12

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BOOK I

LONDON

JOHN MURRAY, ALBEMARLE ST.

1905

PREFACE

"*Mesurez, comptez, pesez, comparez. Intéressez l'enfant à ne jamais faire d'efforts insuffisants ou superflus.*" — ROUSSEAU: *Emile.*

THIS course of elementary mathematics is intended for scholars who have learnt the four rules in money; it assumes no more than a knowledge of these rules, and should be begun as soon as possible after such a knowledge has been acquired.

The method adopted throughout the book is that the materials used for arithmetical calculation shall be got for the most part from reasonably accurate measurements made by each scholar for himself, and that these measurements shall be measurements not merely of drawings, but of actual objects selected for the purpose. In following this method a scholar will, of course, learn a good deal besides pure arithmetic. It will be found, as a rule, that a definite sequence of operations is required of him. That part of an object which is for the time under observation is carefully examined and described, then drawn (either in a hand-sketch or to scale), then measured; calculations arising out of the measurements are then made, each arithmetical and geometrical rule being considered as occasion requires, and stated, as often as not, as an algebraical formula. In other words, the several branches of elementary mathematics (measurement,

drawing, arithmetic, geometry, algebra) are not merely correlated, but actually fused. It is within the experience of the authors that this treatment of mathematics induces the greatest possible interest on the part of the scholars, and makes them realise that the subject is of great importance in daily life.

All rules which have only an academic interest, and which are not generally used in the ordinary calculations which a scholar has to make on leaving school, have been purposely excluded. Amongst these may be mentioned, L.C.M., G.C.M., complex fractions, recurring decimals, and complicated money problems. Weights and measures which are not in common use have been omitted. For the most part, no subject or rule has been introduced until the actual need for it has arisen.

As far as possible, the course has been arranged on heuristic lines. Each scholar is supposed to engage in individual work. He is therefore thrown on his own resources, and must grapple with the various problems himself. It is only in this way that self-help and initiative can be cultivated.

Before commencing the book a scholar should, as already stated, have become acquainted with the four simple rules of arithmetic, including money. He should then work through the chapters in the order given, beginning with decimals. He should keep a note-book, which should be treated as a diary; his description of the work done should be written in such a way as to leave no doubt that it was done by himself. Each day's record of work should be dated. The notes should be written in ink immediately after each measurement or calculation has been made; fair copies should not be allowed. The "exercises" should be worked on separate sheets of paper.

The authors have endeavoured not only to amalgamate the various branches of mathematics, but to break down the water-tight compartments into which each of

the branches is generally divided. The various rules have not, therefore, been introduced and then abandoned; they have been introduced in order that they may be put to constant use. The teacher is, therefore, reminded that there will be little or no need for "revision." When once a rule or operation has been dealt with, its applications will recur again and again throughout the book.

The proofs (or illustrations) of some of the rules are only given in order that the scholars may be led to see that the rules are not mere tricks. It is not intended that the proofs shall be reproduced in examination tests, or even that they shall be remembered. The teacher will, therefore, deal with them as thoroughly as possible when they occur, and push forward.

From what has already been said, it will be understood that it will be neither necessary nor desirable that scholars shall receive separate lessons in Euclid, geometrical drawing, or algebra, while they are working through this book. It will, however, be useful to supplement the lessons here described with exercises on tots, and simple money problems in which speed and mechanical accuracy are required. In order to insure facility and correctness in calculation, the teacher will find it convenient to set frequent "time exercises," in which two or three arithmetical problems (including some of those which are given in these pages) are to be worked in a limited time.

Chapters (or sections) which are confined to geometry should be taken concurrently with the arithmetical exercises at the end of the previous chapter. It will be found advisable to use the exercises for home work, and to take the geometry in school.

All the work which is described in the book can be carried on without any difficulty in an ordinary classroom. The instruments and apparatus required are practically confined to those which are used in elementary geometrical drawing. The various objects

required for measurement can be picked up at a very small cost by those teachers who care to put themselves to a little trouble. For those whose leisure is limited, a list of geometrical models, which can be purchased at a reasonable cost, has been drawn up and printed on p. 10.

It may be added that a companion volume for the use of students in evening schools is in course of preparation. The volume is entitled, *The Rudiments of Practical Mathematics;* the authors are Mr A. Constердine and Mr A. Barnes.

July, 1904.

INSTRUMENTS AND OBJECTS FOR MEASUREMENT

THE following materials are required for the course of work outlined in this book :—

Instruments, etc.—The usual instruments used in geometrical drawing, including dividers, pencil compasses, semicircular protractor, and two set squares (45° and 60°); calipers.

Foot-ruler with cm. and mm. on one edge, and inches and tenths on the other, and on the reverse side twelfths of an inch on one edge and sixteenths on the other; metre rule; yard stick.

Squared paper; transparent tracing-paper.

Hinged planes for illustrating projection.

27 inch-cubes for illustrating the calculation of volumes.

Models.—The following wood models for measurement, together with a few of the instruments mentioned above, may be obtained from Messrs Reynolds & Branson, 14 Commercial Street, Leeds. The models are