# FUNDAMENTALS OF PRACTICAL MATHEMATICS

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Fundamentals of practical mathematics by George Wentworth & David Eugene Smith & Herbert Druery Harper

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GEORGE WENTWORTH & DAVID
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Trieste

WENTWORTH-SMITH MATHEMATICAL SERIES

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BY

GEORGE WENTWORTH

DAVID EUGENE SMITH

AND

HERBERT DRUERY HARPER

GINN AND COMPANY

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# PREFACE

**General Plan.** The development of a more practical type of education in this country has now reached such a stage as to demand a series of textbooks that shall fully meet this need as to content and that shall be prepared with the view to their usability in the classroom. In arranging to meet this demand the authors have made a careful survey of both the general and the vocational schools in the leading cities in the United States, and have come to the conclusion that the most usable type of book should be based upon the assumption that the student has had a good course in elementary arithmetic, including the simple graph, but is in need of a brief review of the fundamental operations. Upon this assumption they have proceeded to build.

The present book contains those basic principles which the student must know, whatever special vocation he is to follow. He may go into machine work of one kind or another, into electrical work, into carpentry, into cabinetwork, into the clothing industry, or into printing, but in any case he will need most of the fundamental work which is set forth in this book. This work consists of a review of such topics as the four fundamental operations with integers and fractions, the practical use of percentage, the applications of proportion, the elements of mensuration, the use of the formula and the equation, the finding of areas by plotting on squared paper, the finding of roots, and the simplest elements of trigonometry. The arrangement of the pages, with the exercises facing the blueprints, will be found especially convenient and will contribute to the general appearance of reality of the work. As to the exercises themselves, they have been carefully chosen from practical fields.

**Practical Nature of the Work.** This review is undertaken, however, with an entirely new set of motives on the part of the student. Instead of mere mechanical drill on abstract calculations he at once finds himself in the atmosphere of the shop, and he meets with precisely the type of problem that will confront him in his practical work. If he has to add fractions he will find the problem related to a blueprint taken from the workroom, and whenever any other operation is to be performed the student will find that the work always relates to a real situation. Arithmetic thus ceases to be merely formal work with abstract numbers, algebra takes on an aspect of genuine utility, trigonometry becomes a tool to be used, and mensuration refers to things that the student knows are worth measuring.

**Schools for which the Work is Adapted.** As stated above, the authors have had in mind the general high school as well as the vocational school. There are many high schools in which certain classes will receive greater benefit from the type of work herein set forth than from the more abstract mathematics commonly offered. The book has therefore been prepared to meet the needs of the junior high school and the four-year high school as well as the needs of the technical and continuation schools.

**Technical Works.** After completing the fundamental work laid down in this textbook the student will be ready to take up the special preparation for his chosen vocation. For this preparation he will need a textbook that relates to the technical work to be undertaken, such, for example, as the "Machine-Shop Mathematics" in this series. For all such special fields the present textbook will be found to give the necessary preparation.

The authors hope that, in preparing a work with the same care that characterizes all the books of the Wentworth-Smith Series, they have taken a forward step in general and vocational education that will meet with the same approval that teachers in this country have so generously given to this series in the past.

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# SYMBOLS

**Symbols.** The following mathematical symbols and abbreviations are used most frequently in the shop:

| | | | |
|---|---|---|---|
| $+$ | plus, addition | 3″ | means 3 inches (3 in.) |
| $-$ | minus, subtraction | 2′ | means 2 feet (2 ft.) |
| $\times$ | times, multiplication; by (as in $2' \times 3'$) | yd. | yard or yards |
| | | sq. | square (as in sq. ft.) |
| $\div$ | divided by, division | $=$ | equal, equals |
| $\sqrt{}$ | square root | $\angle$ | angle |
| $5^2$ | means "5 square," or $5 \times 5$ | # | number (as in marking sizes of wires) |
| : | ratio (as in 2:3) | / | per (as in 7 lb./cu. ft., read "seven pounds per cubic foot") |
| 2/3 | means $\frac{2}{3}$ or $2 \div 3$ | | |
| % | per cent, hundredths | | |

**Conventional Signs.** The following conventional signs are used frequently in the blueprints upon which the exercises are based:

This indicates that part of the rod is omitted in the drawing.

This indicates the point from or to which we measure.

A drafting-room convention for cross sections of the different materials named.

The conventional way to show screw threads.

The conventional way to indicate an incandescent lamp.

# FUNDAMENTALS OF PRACTICAL MATHEMATICS

## CHAPTER I

### FUNDAMENTAL OPERATIONS

**Review of the Fundamentals.** Before beginning this book the student is supposed to be able to add, subtract, multiply, and divide in cases involving whole numbers, decimals, or common fractions. Nevertheless, a brief review of these operations, undertaken from the strictly practical standpoint, will be found desirable unless the student has recently been doing a considerable amount of computing.

**Checks.** Speed is desirable, but accuracy is essential. Therefore *check* every operation.

For example, in this case in addition, first add from the bottom of the column upwards and then check the result by adding from the top downwards.

$$\begin{array}{r} 34.75 \\ 2.864 \\ 10.096 \\ \hline 47.71 \end{array}$$

There are several methods of subtracting. Use the one that you find best, but in any case always check by adding the result to the smaller number and seeing that the sum is the larger number. In the case of the subtraction of 0.638 from 4.07, as here shown, we have $3.432 + 0.638 = 4.07$, and hence the work is correct.

$$\begin{array}{r} 4.07 \\ .638 \\ \hline 3.432 \end{array}$$