Instructor's Guide to Accompany

Mathematics *for* Plumbers *and* Pipefitters

Smith • Eighth Edition

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TO THE INSTRUCTOR

ABOUT THE TEXT

MATHEMATICS FOR PLUMBERS AND PIPE FITTERS provides instructional material for anyone involved with plumbing and pipe fitting who must develop the ability to interpret pipe diagrams and to correctly measure and compute pipe lengths for the installation of required plumbing. After successfully completing the exercises presented in the text, students should understand the mathematics of plumbing and pipe fitting and be able to apply the principles in doing their work.

Section 1, Review of Basic Fundamentals, presents a concise review and practice of the essential principles and processes of mathematics needed to work with the text. It is presumed that students have already had instruction in basic fundamentals.

Section 2, Pipe Length Calculations, deals with the information concerning pipe diagrams and length-of-pipe calculations. The information proceeds logically form simple problems to more complex ones. Each problem is carried through to find the actual lengths to cut the pipe, including fitting allowances.

Section 3, Sheet Metal Work, provides a working knowledge of sheet lead material in weight and thickness. The basic stretchouts and some of their uses are included.

Section 4, Volumes, Pressures, and Capacities, includes units on volumes and their application to plumbing and pipe fitting. Rectangles, cylinders, spheres and segments are presented, with conversion of the volumes to cubic yards, gallons and weight of water—according to trade needs and interests. Advanced work in changing pressure and head as well as in comparing the capacity of pipes to carry water is also provided.

Section 5, Physics, gives practice working with mechanical advantage, states of matter, and properties of gasses.

Section 6, Heating, gives basic instruction in calculating heat loss and in estimating amount of radiation and size of pipe required. Both one-floor and two-floor house plans are included.

Section 7, The Builder's Level, introduces the student to the vocabulary and math aids useful to plumbers in their use of the builder's level.

Section 8, The Business of Plumbing, covers the essentials of planning a business and keeping it financially healthy.

The Appendix consists of tables and specialized data necessary for the solution of various text problems and tables of general, timesaving information. The data tables, which include pipe fitting allowances and constants as well as the powers and roots and decimal-fractional equivalents of many numbers, will still prove useful after the student has completed the course. They will be useful as permanent handbook-type information at any later time a need arises.

ABOUT THE GUIDE

The INSTRUCTORS GUIDE shows basic solution methods and fitting allowances for all problems presented in Section 2, Pipe Length Calculations. Answers also are given for most problems in other sections; solutions and diagrams are given in all cases where it is felt that they will be helpful to the instructor. Because plumbing and pipe- fitting work measurements are usually taken to the closest $\frac{1}{16}$ inch, answers to problems in the text correct within $\frac{1}{16}$ inch are acceptable. An even greater tolerance is allowed for answers given in Section 5, Heating, because when heat loss and radiation are figured, the general practice is to round the numbers to allow for a margin of safety.

READING A TEXTBOOK

In preparation for the use of any text, students should be aware of the particular aids offered. For example, they should be encouraged to answer some of these questions:

- What does the Table of Contents show about the areas covered in this book?
- When was this book copyrighted? Why is this important?
- What is the difference between a section and a unit?
- Does this book have spaces for me to write the answers or do I need my own paper and pencil?
- Does this book have an index? A glossary? An appendix? If not, why not? If so, what information is available in them? When do I need to use them?
- Is an answer key available?

READING AND WRITING MATHEMATICS

   Reading a mathematics textbook requires different skills from reading other types of books. Students should be encouraged to develop some special skills. They should be made aware of the specialized vocabulary and its meaning in mathematics problems. The following steps are helpful in the improvement of mathematical reading ability.

- Read the whole problem to find out what it is about.
- Look for the question or direction that tells what to find or what to do.
- Look carefully at the problem to determine the facts that are given:
    a. Discard irrelevant facts.
    b. Be sure of the meaning of all words, especially mathematical terms.
    c. Consider any conversions necessary, such as feet to inches.
- Plan the steps necessary in order to arrive at the answer:
    a. Are any special computing devices or tools needed, such as a calculator, a steel ruler or a micrometer?
    b. Are any other facts necessary, such as those found in the Appendix?
    c. Does a drawing help relate the facts to each other?
- Prepare the given information:
    a. Relate the facts in a word statement.
    b. Write the numbers, formulas, or symbols necessary.
    c. Estimate the answer.
- Use numbers in the mathematical relationship, and compute the necessary information. Round final answers as directed.
- Verify the answer:
    a. Check the problem by checking the arithmetic processes.
    b. Does the final answer agree with the estimate?
    c. Does the answer sound reasonable for the situation originally described?
    d. Is the answer in the proper units or terminology?

SECTION 1   REVIEW OF BASIC FUNDAMENTALS

UNIT 1   SOME BASIC RULES FOR MATHEMATICS

Answer these questions.
1) What kind of measure is used to describe the size of a car's fuel tank? Cubic, volume, three dimensional.
2) What kind of measure is used to order fabric? Square, area, two dimensional.
3) The distance between cities is expressed with what kind of measure? Lineal or linear.

1. 15.7	4. 1700	7. -3	10. 19	13. 0.333 or ⅓
2. 9.42	5. 8540	8. 9	11. 0	
3. 38.277 or 38.2766	6. -6	9. -2	12. 4	

UNIT 2   FORMULAS

Do the following problems.
1) $3 + 3 \times 4 = 15$
2) $(3 + 3) \times 4 = 24$
3) $3 + (3 \times 4) = 15$
4) $3 + 3 \times 4^2 = 51$

5) $3 + (5 + 4)^2 = 84$
6) $(3 + 5) + 4^2 = 24$
7) $3 + (5 + 4^2) = 24$
8) $3 + 4 \times 3 - 6 = 9$

9) $3 - 6 + 4 \times 3 = 9$
10) $(3 - 6 + 4) \times 3 = 3$
11) $3 - (6 + 4 \times 3) = -15$
12) $3 - [(6 + 4) \times 3] = -27$
13) $\dfrac{11 \times 6^2}{3^2} = 44$

A.
1. $P = 50'\text{-}0''$
2. $9 = 42$ m
3. $P = 67'\text{-}6''$
4. $P = 19.5$ m
5. $C = 40.035''$
6. $C = 101.422$ cm
7. $P = 35.98$ ft.

B.
1. $A = 210.25$ sq. in.
2. $A = 1{,}225 \text{ cm}^2$
3. $A = 15.75$ sq. ft.
4. $A = 15.75 \text{ m}^2$
5. $A = 117$ sq. ft.
6. $A = 216$ sq. in.
7. $A = 864 \text{ cm}^2$
8. $A = 254.34$ sq. in.
9. $A = 2{,}122.64 \text{ cm}^2$
10. $A = 196.25 \text{ cm}^2$

C.
1. $V = 1{,}728$ cu. in.
2. $V = 1{,}000 \text{ cm}^3$
3. $V = 180$ cu. yd.
4. $V = 154 \text{ m}^3$
5. $V = 3{,}264$ cu. ft.
6. $V = 302.76 \text{ cm}^3$
7. $V = 699.435$ cu. ft.
8. $V = 11{,}627.42 \text{ cm}^3$
9. $V = 5{,}699.10$ cu. in.
10. $A = L \times W$
11. $V = S \times S \times h$