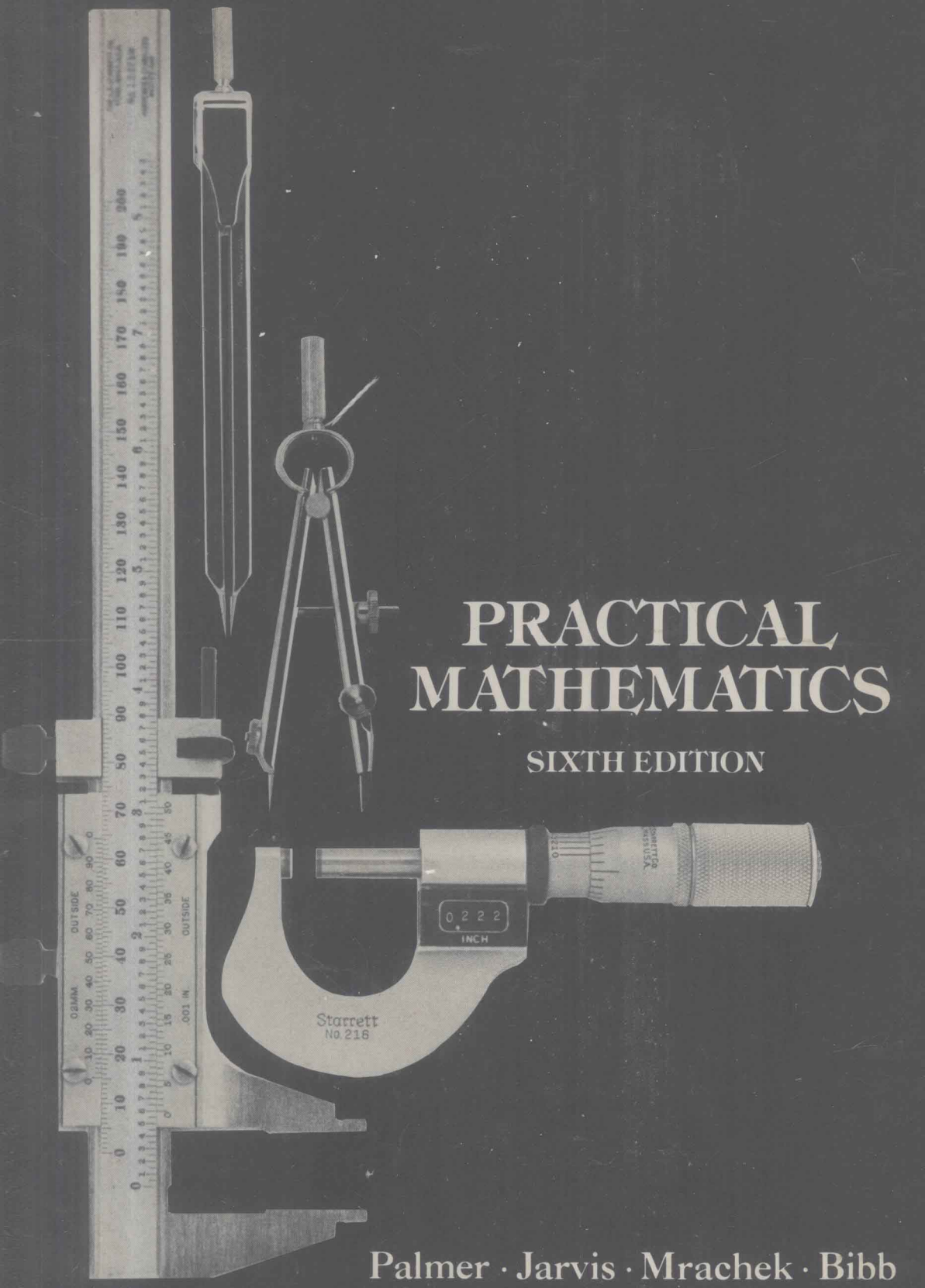

PRACTICAL MATHEMATICS

SIXTH EDITION

Palmer · Jarvis · Mrachek · Bibb

PRACTICAL MATHEMATICS

SIXTH EDITION

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New York	Auckland	London	New Delhi	Singapore
St. Louis	Bogotá	Madrid	Panama	Sydney
Dallas	Düsseldorf	Mexico	Paris	Tokyo
San Francisco	Johannesburg	Montreal	São Paulo	Toronto

Library of Congress Cataloging in Publication Data

Palmer, Claude Irwin, (date)
Practical mathematics.

First-3d ed. published under title: Practical mathematics for home study.
Includes index.
1. Mathematics—1961- I. Title.
QA39.2.P32 1977 512'.1 76-54748
ISBN 0-07-048253-5

The instruments shown on the cover were provided by The L. S. Starrett Company.

PRACTICAL MATHEMATICS, Sixth Edition

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The editors for this book were Gerald O. Stoner and Alice V. Manning, the designer was Tracy A. Glasner, the art supervisor was George T. Resch, and the production supervisor was Regina R. Malone. It was set in Caledonia by Ruttle, Shaw & Wetherill, Inc.
Printed and bound by Kingsport Press, Inc.

PREFACE

Claude Palmer wrote the first edition of Practical Mathematics for his own students. We have tried to maintain his traditional, practical approach to the teaching of trade and industrial mathematics in this sixth edition. For instance, we have not introduced formal mathematical proofs, but have tried to develop each concept by a concise description, fully worked out and applied examples, summary statements, and applied problem materials.

We feel that this revision has met the twin challenges posed by metrication and the emergence of economical hand-held calculators. The chapter on weights and measures has been completely revised to introduce SI metric standards, and approximately 50 percent of the problems use metric measurements.

New material on precision measurement and significant figures has been added, and coverage of exponents, logarithms, and powers of 10 has been revised. A Preface to the Student on purchasing computational aids (the hand-held calculator and the slide rule) has been added.

As in the previous editions, the wealth of applied problems is a major strength. This edition has better than 2000 applied problems, as well as several hundred fully worked out applied examples.

Practical Mathematics is specifically aimed at the postsecondary course in applied mathematics for the trades and technology student. Because of this, we have tried to keep the coverage as broad as possible, while systematically evaluating each concept for relevance to these students. We hope that we have succeeded in maintaining the relationship between essential occupational competencies and the content of this sixth edition.

We would like to thank the Taylor Instrument Process Control Division, Sybron Corporation for permission to reproduce their 24-hour chart, and Mitatoyo Mfg. Co. Ltd. for permission to photograph two of their micrometer calipers. We would also like to thank Gail Hendrix, Carolyn LaFevor, and the late Elliot Nickelson for their numerous suggestions and comments.

John Jarvis

Leonard Mrachek

TO THE STUDENT

When we were developing an outline for this sixth edition, it became apparent that two important developments would influence many of the instructional units. These two developments are the imminent adoption of the metric system and the availability of low-cost hand-held calculators.

Metrication

Many industries in the United States are converting to the metric system of measurement. Consequently, this edition of *Practical Mathematics* has an introductory chapter on the standard metric units, and coverage on how to convert from one system to the other.

Conversion to metric is definitely happening, but the time schedule varies from industry to industry. For instance, electronics is to all intents and purposes already metricated, while construction and other industries with strong systems of sizes will be relatively slow to convert. Therefore, we have increased the number of problems in this edition, and have tried to use metric and traditional measurement equally.

From a teacher's point of view, the major problem in teaching the metric system is motivating the students, who often see this instruction as a senseless complication. We hope you will see the metric system as a positive effort in bringing the world closer together. Better than 90 percent of the world's population uses this standard system of measurement, and most of the world's trade is carried on with metric sizes. Once you become familiar with the various metric measurements, moreover, you will realize that the metric system is very simple to use.

Electronic Calculators

Calculators have been available for many years. Most have been mechanical table-top models, too large or heavy to be portable. The cost of the more versatile calculators has been several hundred dollars.

In the last few years, however, electronic calculators have been developed which are small, light, versatile, and fairly inexpensive. A typical calculator designed to add, subtract, multiply, and divide now may be purchased for only $10.

Electronic hand-held calculators that can be used to perform many

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more mathematical operations may be purchased. However, the greater the number of operations that can be performed with the calculator, the greater the cost.

Electronic hand-held calculators may be classified into one of two groups, general purpose and scientific.

A personal-type hand-held calculator can be used to complete several arithmetic operations. Some of the operations that can be completed with the aid of this electronic calculator are addition, subtraction, multiplication, division, square root, and percentage. Scientific models can complete many more problems than the personal models. However, their cost is much greater than the cost of the personal models. The following list shows the operations that the scientific calculators can do.

Memory
- Automatic four-memory stack
- Addressable memories
- Program memory
- Last x memory

Display
- Fixed notation
- Scientific notation
- Engineering notation

Trigonometric Functions
- Sine, cosine, tangent
- Sine^{-1}, cosine^{-1}, tangent^{-1}
- DMS addition, subtraction

Trigonometric Modes
- Decimal degrees
- Radians
- Grads

Trigonometric Conversions
- Between modes
- To/from degrees, minutes, seconds
- Rectangular/polar

Logarithmic Functions
- Natural log + antilog
- Common log + antilog

Conversions
- Metric/English

Percent Calculations
- Percent amount
- Percent difference
- Percent of sum

Statistical Functions
- Mean/Std. Dev.
- Linear Regression
- Linear estimate
- Trend line

Other
- Pi
- Squares
- Square roots
- Raising numbers to powers
- Absolute value
- Integer/decimal extraction
- Decimal/octal conversion
- Reciprocals

Before you buy an electronic calculator, talk with people working in the field you hope to enter. Get from them an idea of the types of problems they have to solve. Then, make a list of these problems. Prepare a series of sample problems and work these problems on the various models in the store; look at several different brands.

When you work through these problems, check the following:

1. Are the numbers readable?
2. Is the pressure required to depress the key satisfactory?
3. Compare the number of keystrokes necessary to arrive at an answer to a problem.
4. Compare the sequences in which you must depress the keys to obtain the correct answer.
5. Compare the functions possible from model to model.
6. What type of battery is used to power the calculator?
7. Is an adapter available? (An adapter is a charger for rechargeable batteries.)

Electronic calculators are changing rapidly, with new models being added, older models being dropped, and others being changed. Also, many companies are now entering the field by adding electronic calculators to their product line.

A description of many of the calculators now available is included in *Consumer Reports* magazine for September 1975, pages 533–541, and February 1976, pages 86–88. The titles of the articles are *Calculators* and *Scientific Calculators.*

The Slide Rule

Many practitioners use the slide rule instead of the electronic calculator. In the hands of a professional, the slide rule can be nearly as accurate and as fast as the electronic calculator.

The slide rule is a tool which may be used to perform any arithmetical calculation except addition and subtraction. For most calculations, the decimal point must be placed in the answer by the user; the slide rule does not provide automatic placement of the decimal point.

In purchasing a slide rule, you should go through the same steps as in purchasing a calculator: Talk with professionals in your field; make up a set of sample problems; and work these problems through on several models.

We have not included instructions on how to use the calculator or the slide rule in this edition. This is because every model is slightly different from other models. To learn to use your calculator or slide rule, you should read through the owner's handbook which comes with the product. Work out all the sample problems in that manual. Then, start to use your calculator or slide rule to check your answers or homework problems.

Once you have mastered the use of the calculator or slide rule, you may be tempted to do all your homework on it. You should resist

this temptation, especially with new areas of instruction. You will find that new mathematical concepts are best learned by working through them with a paper and pencil. Remember, the slide rule and calculator are only *computational aids*—they can remove some of the drudgery, but they cannot replace mathematical understanding. They are useful only when you understand the mathematics going into them.

We have worked with numbers for many years, and we realize that there will be errors in any revision. For these errors we assume all responsibility. We would appreciate comments and suggestions from the users of this sixth edition of *Practical Mathematics*.

John Jarvis

Leonard Mrachek

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