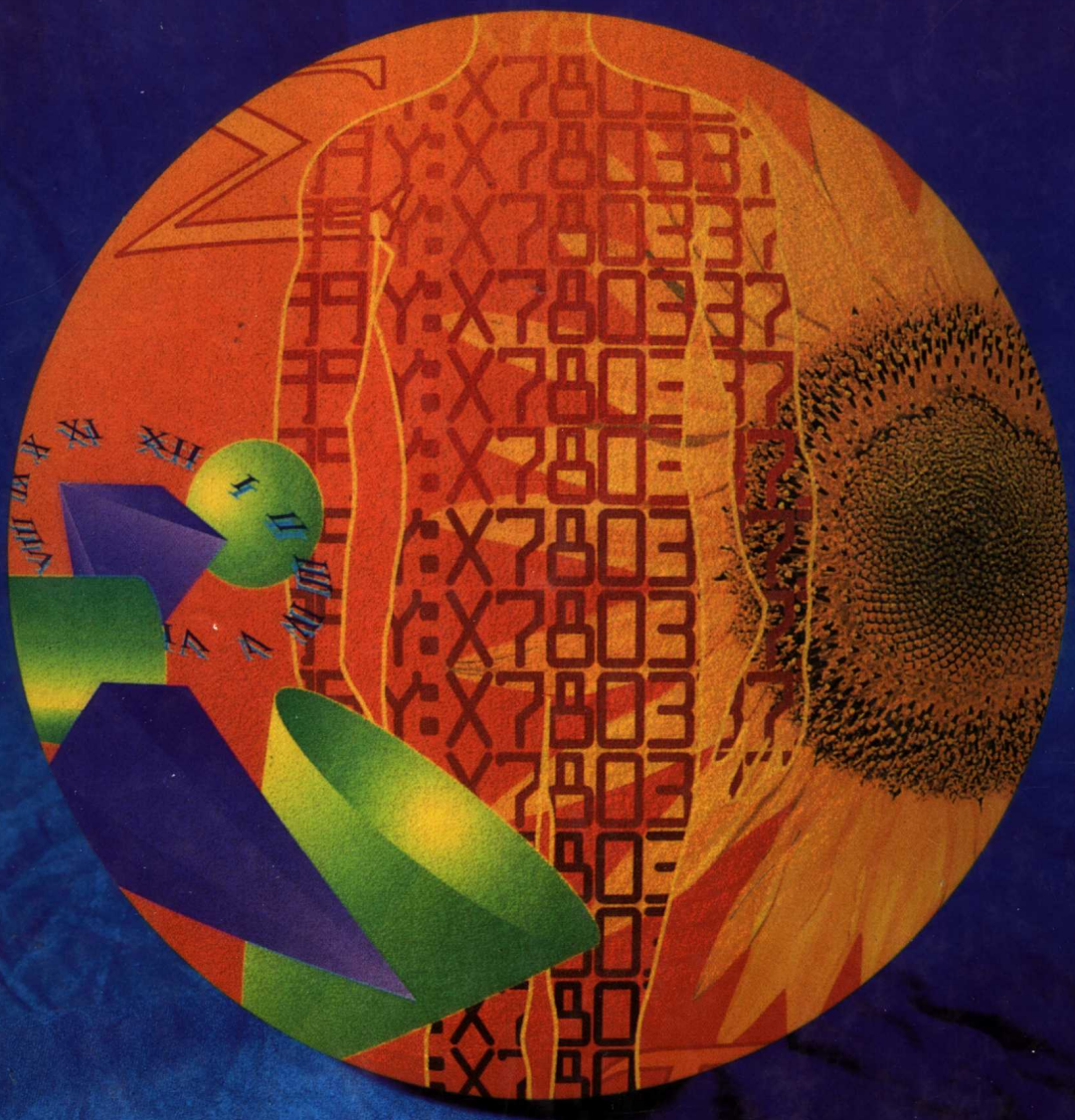
a Survey *of* Mathematics *with* Applications

fourth edition



Angel & Porter

A Survey of Mathematics with Applications

4th Edition

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To my wife, Kathy, and my sons, Robert and Steven
A.R.A.

To my family: Joyce, Lisa, Tod, Teri, Adam, Andrew Matthew, Emily
S.R.P.

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PREFACE

The title of this text, *A Survey of Mathematics with Applications*, provides a key to both its content and the type of course for which it is intended. Prospective users include students majoring in liberal arts, elementary education, the social sciences, business, and nursing and the allied health fields.

This text meets the needs of those states, including California, Florida, New Jersey, and Texas, that now require students to obtain a minimum competency in mathematics for graduation or transfer.

The text may be used in either a one-semester or two-semester course. The flexible structure of the material allows instructors to teach the chapters in any order they wish.

Our primary goal in writing this book was to give students a text that they can read, understand, and enjoy while learning mathematics. We hope that as students read through the text they will begin to understand and enjoy mathematics and possibly decide to venture on to another mathematics course.

FEATURES NEW TO THIS EDITION

In this edition we have made a special effort to provide interesting, informative, and motivational marginal material that illustrates the usefulness of mathematics in our world. Through this material, and the practical applications used in examples and exercises, we hope that students will come to appreciate mathematics and its multifaceted role in their everyday lives.

New features in this edition include:

- Attractive and functional full-color design that not only enhances the text's pedagogy but also serves to highlight motivational material.
- Exciting and motivating photoessays at the beginning of each chapter aimed at showing students the real-world applications of each topic.
- Enhanced, colorful **Did You Know** boxes and other illustrative art that highlight the connections of mathematics to history, to the arts and sciences, to both non-Western and Western cultures, and to technology.
- Biographies of the men and women who have advanced the study of mathematics and mathematical applications.

- Writing exercises that ask students to explain their answers. These exercises are intended to test student understanding of mathematical concepts and processes, and can be used as discussion exercises. They are indicated with a colored number.

PEDAGOGY

In the fourth edition, we have aimed to provide students with features that will help them improve their skills and acquire an understanding of mathematics. We have also designed the pedagogy to make the book both easy to use and to study. Pedagogical features include the following:

- Clear explanations of topics.
- Short, simple sentences to increase the students' understanding of the material.
- An abundance of detailed, worked-out examples.
- An ample supply of well-graded exercises at the end of each section. The more difficult exercises are indicated with an asterisk, *, and the most difficult are under the heading Problem Solving.
- Important information highlighted in color.
- Practical applications used wherever possible to reinforce the material and motivate the student.
- Application problems, which include names from many cultures and portray men and women in non-gender-specific roles.
- Problem-solving exercises at the end of many exercise sets, which reinforce the techniques of problem solving presented in Chapter 1. Many of these problems are excellent assignments for group or cooperative learning projects.
- Research exercises at the end of many exercise sets, which can be assigned to embellish the material. Many of these exercises are appropriate for extra-credit projects.
- Chapter summaries, which include Key Terms and Important Facts, Review Exercises, and Chapter Tests.
- Answers to odd-numbered exercises and to all Review Exercises and Chapter Tests. These are included at the end of the text.

Content Revision

Our revisions to the content are based on the advice of a large number of professors who teach the course. At their request, we have carried out a careful revision of the text to improve the clarity and organization of the material. In addition, we have added or increased coverage of selected topics, as follows:

- An expanded chapter on critical thinking, including a new section on estimation.
- Inclusion of more material on the use of calculators at appropriate locations in the text.
- More examples and more exercises than in previous editions.
- Reorganization of Chapter 2, "Sets."
- Reorganization of Chapter 3, "Logic."
- Increased coverage of number theory.
- A greatly expanded section on the Fibonacci sequence.
- Increased emphasis on formulas and functions in Chapter 6, "Algebra, Graphs, and Functions."
- An expanded chapter on geometry, with additional material on graph theory and fractals, as well as a section on Logo.
- Updated coverage of consumer mathematics topics for the 1990s.
- Reorganization of Chapter 11, "Probability," with a section on conditional probability added.
- Integration of the material on computers into other topics as appropriate.
- Inclusion of a new appendix on the metric system and dimensional analysis.
- Greater emphasis on problem solving throughout the text.

Supplements

A full teaching and learning package accompanies this text and provides resources for both the instructor and the student. Supplements include:

Instructor's Solutions Manual, which contains the worked-out solutions to all exercises in the text.

Omnitest II, an extremely easy-to-use, state-of-the-art computerized testing system. As an algorithm-driven system, it can easily create up to 99 versions of the same test by automatically inserting random numbers into model problems. While the numbers are random, they are constrained to result in reasonable answers. Omnitest II also allows instructors to add and edit questions with full graphics capability, as well as preview and edit items on the screen. It uses pull-down menus for fast access to the functions used most, and utilizes a WYSIWYG ("What You See Is What You Get") interface for perfect match from screen to printout. It runs on IBM PC/compatibles.

Printed Test Bank, which includes three alternative tests per chapter. Instructors can use these items as actual tests or as reference for creating tests with or without the computer.

Student's Solutions Manual, which contains detailed, worked-out solutions to all the odd-numbered exercises in the text. Students will find this manual very helpful.

Guide to CLAST Mathematical Competency (State of Florida), which provides all of the necessary material to help students prepare for the computational portion of the CLAST test. It includes worked-out examples and practice for CLAST skills as well as a practice test. Optional topics in trigonometry are provided for those who wish to brush up in this area as well.

Acknowledgments

We would like to thank the many students and faculty members who offered suggestions for improving the text. We would also like to thank our colleagues at Monroe Community College for their valued suggestions, in particular, Larry Clar, Christine Dunn, Gary Egan, Annette Leopard, and Robert Nenno. Special thanks go to Robert Nenno for his many interesting suggestions for improving the text and to Frank Swetz, Pennsylvania State University at Harrisburg, for providing as well as checking some of the historical **Did You Knows**. We would also like to thank our students for their input and Judy Conturo for typing part of the manuscript.

Our wives, Kathy and Joyce, and our children, Robert and Steven, and Tod, Teri, Lisa, and Brian deserve our special thanks. Without their support and great sacrifice, this book could not have become a reality.

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We would like to acknowledge the contribution of our supplement authors: Christine Dunn and Gary Egan, Monroe Community College, for the *Instructor's Solutions Manual* and *Student's Solutions Manual*; Evelyn Woodward, St. Petersburg Junior College, for the *CLAST Supplement*; ips Publishing, Inc., Vancouver, WA, for *OMNITEST II*.

We would also like to thank all the conscientious reviewers who provided us with invaluable suggestions as well as those who responded to questionnaires and surveys.

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To the Student

Mathematics is an exciting, living study. It has applications that shape the world around you and influence your everyday life. We hope that as you read through this book you will realize just how important mathematics is and gain an appreciation of both its usefulness and its beauty. We also hope to teach you some practical mathematics that you can use in your everyday life and that will prepare you for further courses in mathematics.

Our primary purpose in writing this text was to provide material that you could read, understand, and enjoy. To this end we have used straightforward language and tried to relate mathematical concepts to everyday experiences. We have also provided many detailed examples for you to follow.

The concepts, definitions, and formulas that deserve special attention have been either boxed or set in boldface type. The exercises are graded so that the more difficult problems appear at the end of the exercise set. The problems with numbers set in color are writing exercises. The exercises that are asterisked, *, are more challenging, and the problem-solving problems are the most challenging.

Each chapter has a summary, review exercises, and a chapter test. When studying for a test, be sure to read the chapter summary, work the review exercises, and take the chapter test. The answers to the odd-numbered exercises, all review exercises, and the chapter tests appear in the Answers section in the back of the text. However, you should use the answers only to check your work.

It is difficult to learn mathematics without becoming involved. To be successful, we suggest you read the text carefully *and work each exercise in each assignment in detail*. Check with your instructor to determine which supplements are available for your use. Also determine whether a calculator may be used on homework and tests.

We welcome your suggestions and your comments. Our address is Monroe Community College, Rochester, NY 14623. Good luck in your adventure in mathematics!

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