

EXPANDED SIXTH EDITION

A SURVEY OF

MATHEMATICS

WITH APPLICATIONS



EXPANDED COVERAGE

Graph Theory and
Voting and Apportionment

ANGEL ★ PORTER



A SURVEY OF MATHEMATICS WITH APPLICATIONS

EXPANDED SIXTH EDITION

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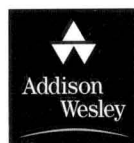
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Illustrations: Tech Graphics, James A. Bryant
Cover Photo: Tony Stone Images

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Library of Congress Cataloging-in-Publication Data

Angel, Allen R., 1942–

A survey of mathematics with applications / Allen Angel, Stuart Porter.—Alternate 6th ed. / with assistance from Christine A. Dunn and Dennis C. Runde.

p. cm.

ISBN 0-201-70308-4

1. Mathematics. I. Porter, Stuart R., 1932– II. Title.

QA39.2 .A54 2001

510—dc21

00-026612

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To my wife, Kathy Angel (photo on page 73)

A.R.A.

MATH: IT'S ALL AROUND US!

We present *A Survey of Mathematics with Applications*, sixth edition, with that vision in mind. Our primary goal in writing this book was to give students a text that they can read, understand, and enjoy while learning how mathematics affects the world around them. Numerous applied examples motivate topics. A variety of interesting applied exercises demonstrate the real-life nature of mathematics and its importance in the students' lives.

The text is intended for students who require a broad-based general overview of mathematics, especially those majoring in the liberal arts, elementary education, the social sciences, business, nursing, and allied health fields. It is particularly suitable for those courses that satisfy the minimum competency requirement in mathematics for graduation or transfer.

Expanded Edition

- This expanded version of *A Survey of Mathematics with Applications, Sixth Edition*, contains all the material covered in the basic text, with additional chapters on *Graph Theory* and *Voting and Apportionment*. While many wished inclusion of these topics, others did not. Therefore, we have written two versions of the book. The expanded version has been priced the same as the basic text to best meet the needs of students.

New and Expanded Features

In this edition we made several important improvements in presentation.

- The interior design has been modified and many new photographs were added to make the book more inviting and motivational.
- The Problem Solving/Group Activity Exercises from the Fifth Edition are now titled Challenge Problem/Group Activity Exercises, and their number has been increased.
- The exercise sets have been redesigned and reclassified to include: Concept/Writing Exercises; Practice the Skills Exercises; Problem Solving Exercises; Challenge Problem/Group Activity Exercises; and Research Activities.
- Sources have been added, up-to-date tables, graphs and charts make the material more relevant and encourage students to read graphs and analyze data.
- Mathematical Modeling is now introduced where appropriate.
- Approximately 40% of the exercises are new.
- The number of writing exercises was increased significantly.
- The number of Research Activities was increased.
- The number of examples was increased throughout the text to promote student understanding.

CONTENT REVISION

In addition we revised and expanded certain topics to introduce new material and to increase understanding.

CHAPTER 1, Critical Thinking Skills, was updated with exciting and current examples and exercises.

CHAPTER 3, Logic, now includes examples and exercises that make use of circle and bar graphs. Material on the negation of the conditional statement also has been added.

CHAPTER 5, Number Theory and the Real Number System, was expanded to include coverage of improper fractions and mixed numbers. The most current number theory information (largest prime number, most accurate value of π , etc) has been included. The use of the scientific calculator has been expanded.

CHAPTER 6, Algebra, Graphs and Functions, has expanded coverage of exponential functions, including additional examples of exponential growth and decay. Section 6.10, Functions and Their Graphs, has been reorganized for greater clarity. Also, material on using a graphing calculator has been included.

CHAPTER 7, Systems of Linear Equations and Inequalities, covers linear programming in more detail. Coverage of using a graphing calculator to find the solution to a system of linear equations is now included.

CHAPTER 8, The Metric System, now includes many examples and interesting photographs of real life (metric) situations taken from around the world.

CHAPTER 9, Geometry, includes expanded coverage of the Klein bottle, the Jordan curves, the 4 color map theorem, and fractals.

CHAPTER 11, Consumer Mathematics, includes current interest rates and updated information on items which may be of interest to students including updated material on sources of credit, and mutual funds. There is also a greater variety of examples and exercises.

CHAPTER 12, Probability, has a greater variety of examples and exercises. More examples and exercises have been added that deal with real life situations.

CHAPTER 13, Statistics, now includes stem-and-leaf displays in the section on statistical graphs.

CHAPTER 14, Graph Theory, is a new chapter to this book.

CHAPTER 15, Voting and Apportionment, is a new chapter to this book.

CONTINUING FEATURES

Several features appear throughout the book, adding interest and provoking thought.

- **Problem Solving** Beginning in Chapter 1, students are introduced to problem solving and critical thinking. The theme of problem solving is then continued throughout the text, and special problem-solving exercises are presented in the exercise sets.
- **Critical Thinking Skills** In addition to a focus on *Problem Solving*, the book also features sections on *Inductive Reasoning* and the important skills of *Estimation* and *Dimensional Analysis*.

- **Profiles in Mathematics** Brief historical sketches and vignettes present the stories of people who have advanced the discipline of mathematics.
- **Chapter Openers** Interesting and motivating photo essays introduce each chapter and illustrate the real-world nature of the chapter topics.
- **Did You Know . . .** These colorful, engaging, and lively boxed features highlight the connections of mathematics to history, to the arts and sciences, to technology, and to a broad variety of disciplines.



INSTRUCTOR'S SUPPLEMENTS

Instructor's Solutions Manual

ISBN 0-201-61324-7

This manual contains detailed, worked-out solutions to all the exercises in the text, and answers to Group Projects.

Instructor's Edition

ISBN 0-201-61326-3

This version of the text includes answers to all of the problems in addition to all of the material found in the student edition.

Instructor's Testing Manual

ISBN 0-201-61325-5

The testing manual includes three alternative tests per chapter. These items may be used as actual tests or as references for creating tests with or without a computer.

TestGen-EQ with QuizMaster-EQ

ISBN 0-201-61330-1

TestGen-EQ is a computerized test generator with algorithmically defined problems organized specifically for this textbook. Its user-friendly graphical interface enables instructors to select, view edit and add test items, then print tests in a variety of fonts and forms. A built-in question editor gives the user the power to create graphs, import graphics, insert mathematical symbols and templates, and insert variable numbers or text. An "Export to HTML" feature lets instructors create practice tests that can be posted to a Web site. Tests created with TestGen-EQ can be used with QuizMaster-EQ, which enables students to take exams on a computer network. QuizMaster-EQ automatically grades the exams, stores results on disk, and allows the instructor to view or print a variety of reports for individual students, classes or courses. Contact your Addison Wesley Longman Sales Consultant.

InterAct Math Plus Software

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Videotapes

ISBN 0-201-61328-X

Videotapes, which correlate to each important topic in the book, are available to departments. Contact your Addison Wesley Longman Sales Consultant.



STUDENT'S SUPPLEMENTS

Student's Solutions Manual

ISBN 0-201-61323-9

This manual contains detailed worked-out solutions to all the odd-numbered section exercises and to all Review and Chapter Test exercises. Students will find this manual very helpful.

Web site

<http://www.awl.com/angel>

The Web site contains additional resources for instructors and students.

Guide to CLAST Mathematical Competency (State of Florida)

ISBN 0-201-61327-1

This guide provides all 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.

InterAct Math Tutorial Software

ISBN 0-201-61332-8

InterAct Math Tutorial Software has been developed and designed by professional software engineers working closely with a team of experienced math educators. InterAct math Tutorial Software includes exercises that are lined with every objective in the textbook and require the same computational and problem-solving skills as their companion exercises in the text. Each exercise has an example and an interactive guided solution that are designed to involve students in the solution process and to help them identify precisely where they are having trouble. The software recognizes common student errors and provides students with appropriate customized feedback. With its sophisticated answer recognition capabilities, InterAct Math Tutorial Software recognizes appropriate forms of the same answer for any kind of input. It also tracks student activity and scores for each section, which can then be printed out. The software is free to qualifying adopters or can be bundled with books for sale to students.

ACKNOWLEDGMENTS

I would like to thank my wife, Kathy, and my children Bob and Steve. Kathy helped with the project in many ways, including typing parts of the manuscript. She was very supportive and was always willing to lend a hand when I needed it.

Stuart Porter did not participate in this revision, but I would like to thank him for his contributions to the past editions of this book. For this edition, I received excellent help from Christine Dunn of Monroe Community College and Dennis Runde of Manatee Community College. Chris and Dennis contributed in a great many ways, and I appreciate their conscientious efforts in behalf of the project.

I would also like to thank Lauri Semarne and Alexis T. Mogill for accuracy checking of the text and answers.

There are many people at Addison Wesley Longman who deserve thanks. I would like to thank all those listed on the Library of Congress categorizing page. In particular, I would like to thank Bill Poole, Senior Acquisitions Editor; Rachel Reeve, Project Manager; Peggy McMahon, Senior Production Supervisor; Carter Fenton, Marketing Manager; Barbara Atkinson, Senior Designer; Bobbie Lewis, Developmental Editor; and Karen Guardino, Managing Editor. I would also like to thank Danielle Meckley and Terri O'Prey of UG / GGS Information Services, Inc., for their assistance as Production Editors for this project.

Gary Egan and Aimee Calhoun of Monroe Community College also deserve my thanks for the excellent work they did on the *Student's Solution Manual* and the *Instructor's Solution Manual*.

Finally, I would like to thank the reviewers from all editions of the book, and all the students who have offered suggestions for improving the book. A list of reviewers for all editions of this book follows. Thanks to all of you for helping to make *A Survey of Mathematics with Applications* the most successful Liberal Arts book in the country.

Allen R. Angel

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*Denotes reviewers for sixth edition.

TO THE STUDENT

Mathematics is an exciting, living study. It has applications that shape the world around you and influence your everyday life. I 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. I 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.

My primary purpose in writing this text was to provide material that you could read, understand, and enjoy. To this end I have used straightforward language and tried to relate mathematical concepts to everyday experiences. I 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. Within each category the exercises are graded so that the more difficult problems appear at the end. The problems with exercise numbers set in color are writing exercises. At the end of most exercise sets are Challenge Problem/Group Activity exercises that contain challenging or exploratory exercises. At the end of each chapter are Group Projects which reinforce the material learned or provide related material.

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 all chapter test exercises appear in the Answer 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, I 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.

I welcome your suggestions and your comments. You may contact me at:

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Good luck in your adventure in mathematics!

Allen R. Angel

CONTENTS

1 CRITICAL THINKING SKILLS 1

- 1.1 Inductive Reasoning 2
- 1.2 Estimation 8
- 1.3 Problem Solving 18
 - Chapter Summary* 32
 - Review Exercises* 32
 - Chapter Test* 35
 - Group Projects* 36

2 SETS 38

- 2.1 Set Concepts 39
- 2.2 Subsets 45
- 2.3 Venn Diagrams and Set Operations 51
- 2.4 Venn Diagrams with Three Sets and Verification of Equality of Sets 59
- 2.5 Applications of Sets 67
- 2.6 Infinite Sets 74
 - Chapter Summary* 77
 - Review Exercises* 78
 - Chapter Test* 79
 - Group Projects* 80

3 LOGIC 82

- 3.1 Statements and Logical Connectives 83
- 3.2 Truth Tables for Negation, Conjunction, and Disjunction 95
- 3.3 Truth Tables for the Conditional and Biconditional 106
- 3.4 Equivalent Statements 114
- 3.5 Symbolic Arguments 127
- 3.6 Euler Diagrams and Syllogistic Arguments 135
 - Chapter Summary* 141
 - Review Exercises* 142
 - Chapter Test* 144
 - Group Projects* 145

4 SYSTEMS OF NUMERATION 147

- 4.1 Additive, Multiplicative, and Ciphred Systems of Numeration 148
- 4.2 Place-Value or Positional-Value Numeration Systems 154
- 4.3 Other Bases 160
- 4.4 Computation in Other Bases 165
- 4.5 Early Computational Methods 174
 - Chapter Summary* 178
 - Review Exercises* 178

Chapter Test 180
Group Projects 180

5 NUMBER THEORY AND THE REAL NUMBER SYSTEM 182

- 5.1 Number Theory 183
- 5.2 The Integers 193
- 5.3 The Rational Numbers 201
- 5.4 The Irrational Numbers and the Real Number System 214
- 5.5 Real Numbers and Their Properties 221
- 5.6 Rules of Exponents and Scientific Notation 227
- 5.7 Arithmetic and Geometric Sequences 237
- 5.8 Fibonacci Sequence 245
 - Chapter Summary* 251
 - Review Exercises* 252
 - Chapter Test* 254
 - Group Projects* 255

6 ALGEBRA, GRAPHS, AND FUNCTIONS 256

- 6.1 Order of Operations 257
- 6.2 Linear Equations in One Variable 261
- 6.3 Formulas 273
- 6.4 Applications of Linear Equations in One Variable 281
- 6.5 Variation 286
- 6.6 Linear Inequalities 294
- 6.7 Graphing Linear Equations 300
- 6.8 Linear Inequalities in Two Variables 314
- 6.9 Solving Quadratic Equations by Using Factoring and by Using the Quadratic Formula 316
- 6.10 Functions and Their Graphs 325
 - Chapter Summary* 339
 - Review Exercises* 339
 - Chapter Test* 342
 - Group Projects* 343

7 SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES 345

- 7.1 Systems of Linear Equations 346
- 7.2 Solving Systems of Equations by the Substitution and Addition Methods 354
- 7.3 Matrices 364
- 7.4 Solving Systems of Equations by Using Matrices 374
- 7.5 Systems of Linear Inequalities 380
- 7.6 Linear Programming 383
 - Chapter Summary* 389
 - Review Exercises* 390

Chapter Test 391

Group Projects 392

8 THE METRIC SYSTEM 393

8.1 Basic Terms and Conversions within the Metric System 394

8.2 Length, Area, and Volume 401

8.3 Mass and Temperature 410

8.4 Dimensional Analysis and Conversions to and from the Metric System 417

Chapter Summary 426

Review Exercises 426

Chapter Test 428

Group Projects 429

9 GEOMETRY 430

9.1 Points, Lines, Planes, and Angles 431

9.2 Polygons 441

9.3 Perimeter and Area 450

9.4 Volume 460

9.5 The Möbius Strip, Klein Bottle, and Maps 471

9.6 Non-Euclidean Geometry and Fractal Geometry 477

Chapter Summary 484

Review Exercises 484

Chapter Test 486

Group Projects 487

10 MATHEMATICAL SYSTEMS 489

10.1 Groups 490

10.2 Finite Mathematical Systems 496

10.3 Modular Arithmetic 506

Chapter Summary 513

Review Exercises 513

Chapter Test 514

Group Projects 515

11 CONSUMER MATHEMATICS 517

11.1 Percent 518

11.2 Personal Loans and Simple Interest 527

11.3 Compound Interest 537

11.4 Installment Buying 545

11.5 Buying a House with a Mortgage 558

Chapter Summary 569

Review Exercises 570

Chapter Test 572

Group Projects 574

12 PROBABILITY 575

- 12.1 The Nature of Probability 576
- 12.2 Theoretical Probability 584
- 12.3 Odds 592
- 12.4 Expected Value (Expectation) 597
- 12.5 Tree Diagrams 605
- 12.6 *Or* and *And* Problems 612
- 12.7 Conditional Probability 623
- 12.8 The Counting Principle and Permutations 628
- 12.9 Combinations 638
- 12.10 Solving Probability Problems by Using Combinations 643
- 12.11 Binomial Probability Formula 649
 - Chapter Summary* 656
 - Review Exercises* 656
 - Chapter Test* 660
 - Group Projects* 661

13 STATISTICS 662

- 13.1 Sampling Techniques 663
- 13.2 The Misuses of Statistics 668
- 13.3 Frequency Distributions 672
- 13.4 Statistical Graphs 677
- 13.5 Measures of Central Tendency 686
- 13.6 Measures of Dispersion 694
- 13.7 The Normal Curve 701
- 13.8 Linear Correlation and Regression 713
 - Chapter Summary* 726
 - Review Exercises* 726
 - Chapter Test* 729
 - Group Projects* 730

14 GRAPH THEORY 731

- 14.1 Graphs, Paths, and Circuits 732
- 14.2 Euler Paths and Euler Circuits 740
- 14.3 Hamilton Paths and Hamilton Circuits 752
- 14.4 Trees 762
 - Chapter Summary* 772
 - Review Exercises* 773
 - Chapter Test* 776
 - Group Projects* 777

15 VOTING AND APPORTIONMENT 778

- 15.1 Voting Systems 779
- 15.2 Flaws of Voting 795