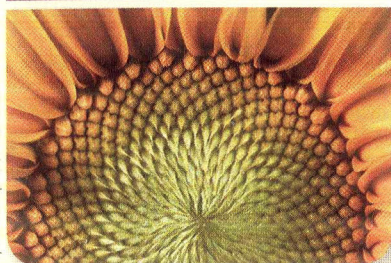


CHAPTER



Dynamic Graphics/PictureQuest

1 Problem Solving

1

1.1 Inductive and Deductive Reasoning 2

EXCURSION: KenKen® Puzzles: An Introduction 8

1.2 Problem Solving with Patterns 16

EXCURSION: Polygonal Numbers 22

1.3 Problem-Solving Strategies 28

EXCURSION: Routes on a Probability Demonstrator 38

Chapter 1 Summary 43 • Chapter 1 Review Exercises 44 •

Chapter 1 Test 48

CHAPTER



Andre Blais/Shutterstock.com

2 Sets

51

2.1 Basic Properties of Sets 52

EXCURSION: Fuzzy Sets 57

2.2 Complements, Subsets, and Venn Diagrams 62

EXCURSION: Subsets and Complements of Fuzzy Sets 67

2.3 Set Operations 71

EXCURSION: Union and Intersection of Fuzzy Sets 80

2.4 Applications of Sets 85

EXCURSION: Voting Systems 91

2.5 Infinite Sets 96

EXCURSION: Transfinite Arithmetic 103

Chapter 2 Summary 106 • Chapter 2 Review Exercises 108 •

Chapter 2 Test 110

CHAPTER**3 Logic****111****3.1 Logic Statements and Quantifiers 112****EXCURSION:** Switching Networks 119**3.2 Truth Tables, Equivalent Statements, and Tautologies 123****EXCURSION:** Switching Networks—Part II 129**3.3 The Conditional and the Biconditional 133****EXCURSION:** Logic Gates 137**3.4 The Conditional and Related Statements 141****EXCURSION:** Sheffer's Stroke and the NAND Gate 144**3.5 Symbolic Arguments 147****EXCURSION:** Fallacies 155**3.6 Arguments and Euler Diagrams 158****EXCURSION:** Using Logic to Solve Cryptarithms 162

Chapter 3 Summary 165 • Chapter 3 Review Exercises 168 •

Chapter 3 Test 170

CHAPTER**4 Apportionment and Voting****171****4.1 Introduction to Apportionment 172****EXCURSION:** Apportioning the 1790 House of Representatives 183**4.2 Introduction to Voting 191****EXCURSION:** Variations of the Borda Count Method 203**4.3 Weighted Voting Systems 212****EXCURSION:** Blocking Coalitions and the Banzhaf Power Index 218

Chapter 4 Summary 223 • Chapter 4 Review Exercises 226 •

Chapter 4 Test 229

CHAPTER**5 The Mathematics of Graphs****231****5.1 Graphs and Euler Circuits 232****EXCURSION:** Pen-Tracing Puzzles 242**5.2 Weighted Graphs 248****EXCURSION:** Extending the Greedy Algorithm 258**5.3 Planarity and Euler's Formula 265****EXCURSION:** The Five Regular Convex Polyhedra 271**5.4 Graph Coloring 276****EXCURSION:** Modeling Traffic Lights with Graphs 283

Chapter 5 Summary 289 • Chapter 5 Review Exercises 291 •

Chapter 5 Test 295

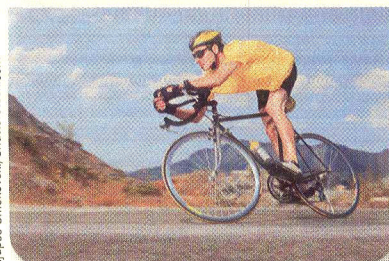
CHAPTER

6 Numeration Systems and Number Theory 299

PictureQuest

- 6.1 Early Numeration Systems 300**
EXCURSION: A Rosetta Tablet for the Traditional Chinese Numeration System 304
 - 6.2 Place-Value Systems 307**
EXCURSION: Subtraction via the Nines Complement and the End-Around Carry 314
 - 6.3 Different Base Systems 317**
EXCURSION: Information Retrieval via a Binary Search 323
 - 6.4 Arithmetic in Different Bases 327**
EXCURSION: Subtraction in Base Two via the Ones Complement and the End-Around Carry 335
 - 6.5 Prime Numbers 338**
EXCURSION: The Distribution of the Primes 343
 - 6.6 Topics from Number Theory 347**
EXCURSION: A Sum of the Divisors Formula 354
- Chapter 6 Summary 357 • Chapter 6 Review Exercises 359 • Chapter 6 Test 361

CHAPTER

7 Geometry 363

Ljupco Smokovski/Shutterstock.com

- 7.1 Basic Concepts of Euclidean Geometry 364**
EXCURSION: Preparing a Circle Graph 374
 - 7.2 Perimeter and Area of Plane Figures 382**
EXCURSION: Perimeter and Area of a Rectangle with Changing Dimensions 396
 - 7.3 Properties of Triangles 405**
EXCURSION: Topology: A Brief Introduction 412
 - 7.4 Volume and Surface Area 419**
EXCURSION: Water Displacement 426
 - 7.5 Right Triangle Trigonometry 432**
EXCURSION: Approximating the Value of Trigonometric Ratios 438
 - 7.6 Non-Euclidean Geometry 442**
EXCURSION: Finding Geodesics 450
 - 7.7 Fractals 454**
EXCURSION: The Heighway Dragon Fractal 462
- Chapter 7 Summary 466 • Chapter 7 Review Exercises 469 • Chapter 7 Test 471

CHAPTER**8 Mathematical Systems****473****8.1 Modular Arithmetic 474****EXCURSION:** Computing the Day of the Week 481**8.2 Applications of Modular Arithmetic 484****EXCURSION:** Public Key Cryptography 492**8.3 Introduction to Group Theory 495****EXCURSION:** Wallpaper Groups 503

Chapter 8 Summary 508 • Chapter 8 Review Exercises 510 •

Chapter 8 Test 511

CHAPTER**9 Applications of Equations****513****9.1 First-Degree Equations and Formulas 514****EXCURSION:** Body Mass Index 523**9.2 Rate, Ratio, and Proportion 530****EXCURSION:** Earned Run Average 539**9.3 Percent 546****EXCURSION:** Federal Income Tax 557**9.4 Second-Degree Equations 564****EXCURSION:** The Sum and Product of the Solutions of a Quadratic Equation 571

Chapter 9 Summary 577 • Chapter 9 Review Exercises 578 •

Chapter 9 Test 581

CHAPTER**10 Applications of Functions****585****10.1 Rectangular Coordinates and Functions 586****EXCURSION:** Dilations of a Geometric Figure 593**10.2 Properties of Linear Functions 596****EXCURSION:** Negative Velocity 604**10.3 Finding Linear Models 608****EXCURSION:** A Linear Business Model 614**10.4 Quadratic Functions 618****EXCURSION:** Reflective Properties of a Parabola 623**10.5 Exponential Functions 629****EXCURSION:** Chess and Exponential Functions 636**10.6 Logarithmic Functions 640****EXCURSION:** Benford's Law 649

Chapter 10 Summary 652 • Chapter 10 Review Exercises 655 •

Chapter 10 Test 657



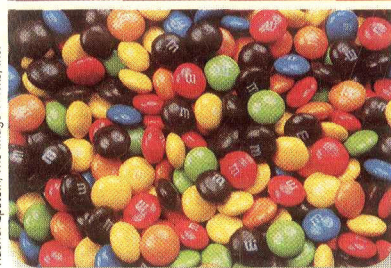
CHAPTER

Alex Wong/Getty Images

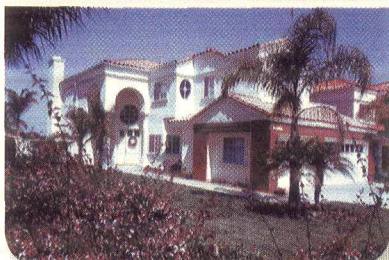
**11 The Mathematics of Finance****659****11.1 Simple Interest 660****EXCURSION:** Day-of-the-Year Table 666**11.2 Compound Interest 671****EXCURSION:** Consumer Price Index 684**11.3 Credit Cards and Consumer Loans 691****EXCURSION:** Car Leases 700**11.4 Stocks, Bonds, and Mutual Funds 706****EXCURSION:** Treasury Bills 711**11.5 Home Ownership 715****EXCURSION:** Home Ownership Issues 723Chapter 11 Summary 727 • Chapter 11 Review Exercises 729 •
Chapter 11 Test 731

CHAPTER

Rachel Epstein/The Image Works, Inc.

**12 Combinatorics and Probability****733****12.1 The Counting Principle 734****EXCURSION:** Decision Trees 740**12.2 Permutations and Combinations 744****EXCURSION:** Choosing Numbers in Keno 752**12.3 Probability and Odds 756****EXCURSION:** The Value of Pi by Simulation 764**12.4 Addition and Complement Rules 768****EXCURSION:** Keno Revisited 774**12.5 Conditional Probability 778****EXCURSION:** Sharing Birthdays 784**12.6 Expectation 788****EXCURSION:** Chuck-a-luck 792Chapter 12 Summary 795 • Chapter 12 Review Exercises 798 •
Chapter 12 Test 801

CHAPTER



Spencer Grant/PhotoEdit, Inc.

13 Statistics**803****13.1 Measures of Central Tendency 804****EXCURSION:** Linear Interpolation and Animation 810**13.2 Measures of Dispersion 815****EXCURSION:** A Geometric View of Variance and Standard Deviation 821**13.3 Measures of Relative Position 826****EXCURSION:** Stem-and-Leaf Diagrams 833**13.4 Normal Distributions 837****EXCURSION:** Cut-Off Scores 846**13.5 Linear Regression and Correlation 850****EXCURSION:** An Application of Linear Regression 857**Chapter 13 Summary 863 • Chapter 13 Review Exercises 865 •****Chapter 13 Test 868**■ **Appendix A: The Metric System of Measurement 871**■ **Appendix B: Table of Measurement Abbreviations 877**■ **Solutions to Check Your Progress Problems S1**■ **Answers to Selected Exercises A1**■ **Index of Applications I1**■ **Index I5**

■ **Web Appendix: Algebra Review** (Available only online at this textbook's website at: www.cengage.com/math/aufmann. Select Mathematical Excursions, 3/e, Students: Access Free Companion Content, then click on ACCESS NOW.)