

# CONTENTS

PREFACE x

TO THE STUDENT xvii

PROLOGUE: PRINCIPLES OF PROBLEM SOLVING P1

## CHAPTER 1 FUNDAMENTALS 1

---

Chapter Overview 1

- 1.1** Real Numbers 2
  - 1.2** Exponents and Radicals 13
  - 1.3** Algebraic Expressions 25
  - 1.4** Rational Expressions 36
  - 1.5** Equations 45
  - 1.6** Complex Numbers 59
  - 1.7** Modeling with Equations 65
  - 1.8** Inequalities 81
  - 1.9** The Coordinate Plane; Graphs of Equations; Circles 92
  - 1.10** Lines 106
  - 1.11** Solving Equations and Inequalities Graphically 117
  - 1.12** Modeling Variation 122
- Chapter 1 Review 130
- Chapter 1 Test 137
- **FOCUS ON MODELING** Fitting Lines to Data 139

## CHAPTER 2 FUNCTIONS 147

---

Chapter Overview 147

- 2.1** Functions 148
  - 2.2** Graphs of Functions 159
  - 2.3** Getting Information from the Graph of a Function 170
  - 2.4** Average Rate of Change of a Function 183
  - 2.5** Linear Functions and Models 190
  - 2.6** Transformations of Functions 198
  - 2.7** Combining Functions 210
  - 2.8** One-to-One Functions and Their Inverses 219
- Chapter 2 Review 229
- Chapter 2 Test 235
- **FOCUS ON MODELING** Modeling with Functions 237

<b>CHAPTER 3</b>	<b>POLYNOMIAL AND RATIONAL FUNCTIONS</b>	<b>245</b>
	Chapter Overview	245
<b>3.1</b>	Quadratic Functions and Models	246
<b>3.2</b>	Polynomial Functions and Their Graphs	254
<b>3.3</b>	Dividing Polynomials	269
<b>3.4</b>	Real Zeros of Polynomials	275
<b>3.5</b>	Complex Zeros and the Fundamental Theorem of Algebra	287
<b>3.6</b>	Rational Functions	295
<b>3.7</b>	Polynomial and Rational Inequalities	311
	Chapter 3 Review	317
	Chapter 3 Test	323
■	<b>FOCUS ON MODELING</b> Fitting Polynomial Curves to Data	325
<b>CHAPTER 4</b>	<b>EXPONENTIAL AND LOGARITHMIC FUNCTIONS</b>	<b>329</b>
	Chapter Overview	329
<b>4.1</b>	Exponential Functions	330
<b>4.2</b>	The Natural Exponential Function	338
<b>4.3</b>	Logarithmic Functions	344
<b>4.4</b>	Laws of Logarithms	354
<b>4.5</b>	Exponential and Logarithmic Equations	360
<b>4.6</b>	Modeling with Exponential Functions	370
<b>4.7</b>	Logarithmic Scales	381
	Chapter 4 Review	386
	Chapter 4 Test	391
■	<b>FOCUS ON MODELING</b> Fitting Exponential and Power Curves to Data	392
	Cumulative Review Test: Chapters 2, 3, and 4 (Website)	
<b>CHAPTER 5</b>	<b>TRIGONOMETRIC FUNCTIONS: UNIT CIRCLE APPROACH</b>	<b>401</b>
	Chapter Overview	401
<b>5.1</b>	The Unit Circle	402
<b>5.2</b>	Trigonometric Functions of Real Numbers	409
<b>5.3</b>	Trigonometric Graphs	419
<b>5.4</b>	More Trigonometric Graphs	432
<b>5.5</b>	Inverse Trigonometric Functions and Their Graphs	439
<b>5.6</b>	Modeling Harmonic Motion	445
	Chapter 5 Review	460
	Chapter 5 Test	465
■	<b>FOCUS ON MODELING</b> Fitting Sinusoidal Curves to Data	466

<b>CHAPTER 6</b>	<b>TRIGONOMETRIC FUNCTIONS: RIGHT TRIANGLE APPROACH</b>	<b>471</b>
	Chapter Overview 471	
<b>6.1</b>	Angle Measure 472	
<b>6.2</b>	Trigonometry of Right Triangles 482	
<b>6.3</b>	Trigonometric Functions of Angles 491	
<b>6.4</b>	Inverse Trigonometric Functions and Right Triangles 501	
<b>6.5</b>	The Law of Sines 508	
<b>6.6</b>	The Law of Cosines 516	
	Chapter 6 Review 524	
	Chapter 6 Test 531	
	■ <b>FOCUS ON MODELING</b> Surveying 533	
<b>CHAPTER 7</b>	<b>ANALYTIC TRIGONOMETRY</b>	<b>537</b>
	Chapter Overview 537	
<b>7.1</b>	Trigonometric Identities 538	
<b>7.2</b>	Addition and Subtraction Formulas 545	
<b>7.3</b>	Double-Angle, Half-Angle, and Product-Sum Formulas 553	
<b>7.4</b>	Basic Trigonometric Equations 564	
<b>7.5</b>	More Trigonometric Equations 570	
	Chapter 7 Review 576	
	Chapter 7 Test 580	
	■ <b>FOCUS ON MODELING</b> Traveling and Standing Waves 581	
	Cumulative Review Test: Chapters 5, 6, and 7 (Website)	
<b>CHAPTER 8</b>	<b>POLAR COORDINATES AND PARAMETRIC EQUATIONS</b>	<b>587</b>
	Chapter Overview 587	
<b>8.1</b>	Polar Coordinates 588	
<b>8.2</b>	Graphs of Polar Equations 594	
<b>8.3</b>	Polar Form of Complex Numbers; De Moivre's Theorem 602	
<b>8.4</b>	Plane Curves and Parametric Equations 611	
	Chapter 8 Review 620	
	Chapter 8 Test 624	
	■ <b>FOCUS ON MODELING</b> The Path of a Projectile 625	

**CHAPTER 9** **VECTORS IN TWO AND THREE DIMENSIONS** **629**

Chapter Overview 629

- 9.1** Vectors in Two Dimensions 630
  - 9.2** The Dot Product 639
  - 9.3** Three-Dimensional Coordinate Geometry 647
  - 9.4** Vectors in Three Dimensions 653
  - 9.5** The Cross Product 659
  - 9.6** Equations of Lines and Planes 666
- Chapter 9 Review 670  
Chapter 9 Test 675

- **FOCUS ON MODELING** Vector Fields 676
- Cumulative Review Test: Chapters 8 and 9 (Website)

**CHAPTER 10** **SYSTEMS OF EQUATIONS AND INEQUALITIES** **679**

Chapter Overview 679

- 10.1** Systems of Linear Equations in Two Variables 680
  - 10.2** Systems of Linear Equations in Several Variables 690
  - 10.3** Matrices and Systems of Linear Equations 699
  - 10.4** The Algebra of Matrices 712
  - 10.5** Inverses of Matrices and Matrix Equations 724
  - 10.6** Determinants and Cramer's Rule 734
  - 10.7** Partial Fractions 745
  - 10.8** Systems of Nonlinear Equations 751
  - 10.9** Systems of Inequalities 756
- Chapter 10 Review 766  
Chapter 10 Test 773

- **FOCUS ON MODELING** Linear Programming 775

**CHAPTER 11** **CONIC SECTIONS** **781**

Chapter Overview 781

- 11.1** Parabolas 782
  - 11.2** Ellipses 790
  - 11.3** Hyperbolas 799
  - 11.4** Shifted Conics 807
  - 11.5** Rotation of Axes 816
  - 11.6** Polar Equations of Conics 824
- Chapter 11 Review 831  
Chapter 11 Test 835

- **FOCUS ON MODELING** Conics in Architecture 836
- Cumulative Review Test: Chapters 10 and 11 (Website)

## CHAPTER 12 SEQUENCES AND SERIES 841

---

Chapter Overview 841

**12.1** Sequences and Summation Notation 842

**12.2** Arithmetic Sequences 853

**12.3** Geometric Sequences 858

**12.4** Mathematics of Finance 867

**12.5** Mathematical Induction 873

**12.6** The Binomial Theorem 879

Chapter 12 Review 887

Chapter 12 Test 892

■ **FOCUS ON MODELING** Modeling with Recursive Sequences 893

## CHAPTER 13 LIMITS: A PREVIEW OF CALCULUS 897

---

Chapter Overview 897

**13.1** Finding Limits Numerically and Graphically 898

**13.2** Finding Limits Algebraically 906

**13.3** Tangent Lines and Derivatives 914

**13.4** Limits at Infinity; Limits of Sequences 924

**13.5** Areas 931

Chapter 13 Review 940

Chapter 13 Test 943

■ **FOCUS ON MODELING** Interpretations of Area 944

Cumulative Review Test: Chapters 12 and 13 (Website)

APPENDIX A Geometry Review 949

APPENDIX B Calculations and Significant Figures (Website)

APPENDIX C Graphing with a Graphing Calculator (Website)

APPENDIX D Using the TI-83/84 Graphing Calculator (Website)

ANSWERS A1

INDEX I1