

ANNOTATED INSTRUCTOR'S EDITION

Precalculus

Enhanced with Graphing Utilities

Eighth Edition

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Contents

Three Distinct Series	xix
The Enhanced with Graphing Utilities Series	xx
Preface to the Instructor	xxi
Applications Index	xxix
To the Student	xxxiv

1	Graphs	1
1.1	Graphing Utilities; Introduction to Graphing Equations	2
	Graph Equations by Plotting Points • Graph Equations Using a Graphing Utility • Use a Graphing Utility to Create Tables • Find Intercepts from a Graph • Use a Graphing Utility to Approximate Intercepts	
1.2	The Distance and Midpoint Formulas	13
	Use the Distance Formula • Use the Midpoint Formula	
1.3	Intercepts; Symmetry; Graphing Key Equations	20
	Find Intercepts Algebraically from an Equation • Test an Equation for Symmetry with Respect to the x -Axis, the y -Axis, and the Origin • Know How to Graph Key Equations	
1.4	Solving Equations Using a Graphing Utility	28
	Solve Equations Using a Graphing Utility	
1.5	Lines	32
	Calculate and Interpret the Slope of a Line • Graph Lines Given a Point and the Slope • Find the Equation of a Vertical Line • Use the Point-Slope Form of a Line; Identify Horizontal Lines • Use the Slope-Intercept Form of a Line • Find the Equation of a Line Given Two Points • Graph Lines Written in General Form Using Intercepts • Find Equations of Parallel Lines • Find Equations of Perpendicular Lines	
1.6	Circles	47
	Write the Standard Form of the Equation of a Circle • Graph a Circle by Hand and by Using a Graphing Utility • Work with the General Form of the Equation of a Circle	
	Chapter Review	55
	Chapter Test	57
	Chapter Project	58

2	Functions and Their Graphs	59
2.1	Functions	60
	Describe a Relation • Determine Whether a Relation Represents a Function • Use Function Notation; Find the Value of a Function • Find the Difference Quotient of a Function • Find the Domain of a Function Defined by an Equation • Form the Sum, Difference, Product, and Quotient of Two Functions	
2.2	The Graph of a Function	76
	Identify the Graph of a Function • Obtain Information from or about the Graph of a Function	

2.3 Properties of Functions	86
Identify Even and Odd Functions from a Graph • Identify Even and Odd Functions from an Equation • Use a Graph to Determine Where a Function Is Increasing, Decreasing, or Constant • Use a Graph to Locate Local Maxima and Local Minima • Use a Graph to Locate the Absolute Maximum and the Absolute Minimum • Use a Graphing Utility to Approximate Local Maxima and Local Minima and to Determine Where a Function Is Increasing or Decreasing • Find the Average Rate of Change of a Function	
2.4 Library of Functions; Piecewise-defined Functions	100
Graph the Functions Listed in the Library of Functions • Analyze a Piecewise-defined Function	
2.5 Graphing Techniques: Transformations	112
Graph Functions Using Vertical and Horizontal Shifts • Graph Functions Using Compressions and Stretches • Graph Functions Using Reflections about the x -Axis or y -Axis	
2.6 Mathematical Models: Building Functions	126
Build and Analyze Functions	
Chapter Review	131
Chapter Test	135
Cumulative Review	136
Chapter Projects	136

3 Linear and Quadratic Functions 138

3.1 Properties of Linear Functions and Linear Models	139
Graph Linear Functions • Use Average Rate of Change to Identify Linear Functions • Determine Whether a Linear Function Is Increasing, Decreasing, or Constant • Build Linear Models from Verbal Descriptions	
3.2 Building Linear Models from Data	149
Draw and Interpret Scatter Plots • Distinguish between Linear and Nonlinear Relations • Use a Graphing Utility to Find the Line of Best Fit	
3.3 Quadratic Functions and Their Properties	157
Graph a Quadratic Function Using Transformations • Identify the Vertex and Axis of Symmetry of a Parabola • Graph a Quadratic Function Using Its Vertex, Axis, and Intercepts • Find a Quadratic Function Given Its Vertex and One Other Point • Find the Maximum or Minimum Value of a Quadratic Function	
3.4 Building Quadratic Models from Verbal Descriptions and from Data	171
Build Quadratic Models from Verbal Descriptions • Build Quadratic Models from Data	
3.5 Inequalities Involving Quadratic Functions	179
Solve Inequalities Involving a Quadratic Function	
Chapter Review	183
Chapter Test	185
Cumulative Review	186
Chapter Projects	187

4 Polynomial and Rational Functions 188

4.1 Polynomial Functions 189

Identify Polynomial Functions and Their Degree • Graph Polynomial Functions Using Transformations • Identify the Real Zeros of a Polynomial Function and Their Multiplicity

4.2 The Graph of a Polynomial Function; Models 204

Analyze the Graph of a Polynomial Function • Build Cubic Models from Data

4.3 The Real Zeros of a Polynomial Function 213

Use the Remainder and Factor Theorems • Use Descartes' Rule of Signs to Determine the Number of Positive and the Number of Negative Real Zeros of a Polynomial Function • Use the Rational Zeros Theorem to List the Potential Rational Zeros of a Polynomial Function • Find the Real Zeros of a Polynomial Function • Solve Polynomial Equations • Use the Theorem for Bounds on Zeros • Use the Intermediate Value Theorem

4.4 Complex Zeros; Fundamental Theorem of Algebra 228

Use the Conjugate Pairs Theorem • Find a Polynomial Function with Specified Zeros • Find the Complex Zeros of a Polynomial Function

4.5 Properties of Rational Functions 235

Find the Domain of a Rational Function • Find the Vertical Asymptotes of a Rational Function • Find the Horizontal or Oblique Asymptote of a Rational Function

4.6 The Graph of a Rational Function 246

Analyze the Graph of a Rational Function • Solve Applied Problems Involving Rational Functions

4.7 Polynomial and Rational Inequalities 258

Solve Polynomial Inequalities Graphically and Algebraically • Solve Rational Inequalities Graphically and Algebraically

Chapter Review 265

Chapter Test 268

Cumulative Review 268

Chapter Projects 270

5 Exponential and Logarithmic Functions 271

5.1 Composite Functions 272

Form a Composite Function • Find the Domain of a Composite Function

5.2 One-to-One Functions; Inverse Functions 280

Determine Whether a Function Is One-to-One • Determine the Inverse of a Function Defined by a Mapping or a Set of Ordered Pairs • Obtain the Graph of the Inverse Function from the Graph of a One-to-One Function • Verify that a Function Defined by an Equation Is an Inverse Function • Find the Inverse of a Function Defined by an Equation

5.3 Exponential Functions 293

Evaluate Exponential Functions • Graph Exponential Functions • Define the Number e • Solve Exponential Equations

5.4 Logarithmic Functions 312

Change Exponential Statements to Logarithmic Statements and Logarithmic Statements to Exponential Statements • Evaluate Logarithmic Expressions • Determine the Domain of a Logarithmic Function • Graph Logarithmic Functions • Solve Logarithmic Equations

5.5 Properties of Logarithms	326
Work with the Properties of Logarithms • Write a Logarithmic Expression as a Sum or Difference of Logarithms • Write a Logarithmic Expression as a Single Logarithm • Evaluate Logarithms Whose Base Is Neither 10 Nor e • Graph a Logarithmic Function Whose Base is Neither 10 Nor e	
5.6 Logarithmic and Exponential Equations	335
Solve Logarithmic Equations • Solve Exponential Equations • Solve Logarithmic and Exponential Equations Using a Graphing Utility	
5.7 Financial Models	344
Determine the Future Value of a Lump Sum of Money • Calculate Effective Rates of Return • Determine the Present Value of a Lump Sum of Money • Determine the Rate of Interest or the Time Required to Double a Lump Sum of Money	
5.8 Exponential Growth and Decay Models; Newton's Law; Logistic Growth and Decay Models	354
Model Populations That Obey the Law of Uninhibited Growth • Model Populations That Obey the Law of Uninhibited Decay • Use Newton's Law of Cooling • Use Logistic Models	
5.9 Building Exponential, Logarithmic, and Logistic Models from Data	365
Build an Exponential Model from Data • Build a Logarithmic Model from Data • Build a Logistic Model from Data	
Chapter Review	373
Chapter Test	378
Cumulative Review	379
Chapter Projects	380

6 Trigonometric Functions 381

6.1 Angles, Arc Length, and Circular Motion	382
Angles and Degree Measure • Convert between Decimal and Degree, Minute, Second Measures for Angles • Find the Length of an Arc of a Circle • Convert from Degrees to Radians and from Radians to Degrees • Find the Area of a Sector of a Circle • Find the Linear Speed of an Object Traveling in Circular Motion	
6.2 Trigonometric Functions: Unit Circle Approach	395
Find the Exact Values of the Trigonometric Functions Using a Point on the Unit Circle • Find the Exact Values of the Trigonometric Functions of Quadrantal Angles • Find the Exact Values of the Trigonometric Functions of $\frac{\pi}{4} = 45^\circ$ • Find the Exact Values of the Trigonometric Functions of $\frac{\pi}{6} = 30^\circ$ and $\frac{\pi}{3} = 60^\circ$ • Find the Exact Values of the Trigonometric Functions for Integer Multiples of $\frac{\pi}{6} = 30^\circ$, $\frac{\pi}{4} = 45^\circ$, and $\frac{\pi}{3} = 60^\circ$ • Use a Calculator to Approximate the Value of a Trigonometric Function • Use a Circle of Radius r to Evaluate the Trigonometric Functions	
6.3 Properties of the Trigonometric Functions	412
Determine the Domain and the Range of the Trigonometric Functions • Determine the Period of the Trigonometric Functions • Determine the Signs of the Trigonometric Functions in a Given Quadrant • Find the Values of the Trigonometric Functions Using Fundamental Identities • Find the Exact Values of the Trigonometric Functions of an Angle Given One of the Functions and the Quadrant of the Angle • Use Even-Odd Properties to Find the Exact Values of the Trigonometric Functions	

6.4 Graphs of the Sine and Cosine Functions **427**

Graph the Sine Function $y = \sin x$ and Functions of the Form $y = A \sin(\omega x)$ • Graph the Cosine Function $y = \cos x$ and Functions of the Form $y = A \cos(\omega x)$ • Determine the Amplitude and Period of Sinusoidal Functions • Graph Sinusoidal Functions Using Key Points • Find an Equation for a Sinusoidal Graph

6.5 Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions **443**

Graph the Tangent Function $y = \tan x$ and the Cotangent Function $y = \cot x$ • Graph Functions of the Form $y = A \tan(\omega x) + B$ and $y = A \cot(\omega x) + B$ • Graph the Cosecant Function $y = \csc x$ and the Secant Function $y = \sec x$ • Graph Functions of the Form $y = A \csc(\omega x) + B$ and $y = A \sec(\omega x) + B$

6.6 Phase Shift; Sinusoidal Curve Fitting **451**

Graph Sinusoidal Functions of the Form $y = A \sin(\omega x - \phi) + B$ • Build Sinusoidal Models from Data

Chapter Review **462**

Chapter Test **468**

Cumulative Review **468**

Chapter Projects **469**

7 Analytic Trigonometry **471****7.1 The Inverse Sine, Cosine, and Tangent Functions** **472**

Define the Inverse Sine Function • Find the Value of an Inverse Sine Function • Define the Inverse Cosine Function • Find the Value of an Inverse Cosine Function • Define the Inverse Tangent Function • Find the Value of an Inverse Tangent Function • Use Properties of Inverse Functions to Find Exact Values of Certain Composite Functions • Find the Inverse Function of a Trigonometric Function • Solve Equations Involving Inverse Trigonometric Functions

7.2 The Inverse Trigonometric Functions (Continued) **487**

Define the Inverse Secant, Cosecant, and Cotangent Functions • Find the Value of Inverse Secant, Cosecant, and Cotangent Functions • Find the Exact Value of Composite Functions Involving the Inverse Trigonometric Functions • Write a Trigonometric Expression as an Algebraic Expression

7.3 Trigonometric Equations **493**

Solve Equations Involving a Single Trigonometric Function • Solve Trigonometric Equations Using a Calculator • Solve Trigonometric Equations Quadratic in Form • Solve Trigonometric Equations Using Fundamental Identities • Solve Trigonometric Equations Using a Graphing Utility

7.4 Trigonometric Identities **503**

Use Algebra to Simplify Trigonometric Expressions • Establish Identities

7.5 Sum and Difference Formulas **511**

Use Sum and Difference Formulas to Find Exact Values • Use Sum and Difference Formulas to Establish Identities • Use Sum and Difference Formulas Involving Inverse Trigonometric Functions • Solve Trigonometric Equations Linear in Sine and Cosine

7.6 Double-angle and Half-angle Formulas **524**

Use Double-angle Formulas to Find Exact Values • Use Double-angle Formulas to Establish Identities • Use Half-angle Formulas to Find Exact Values

7.7 Product-to-Sum and Sum-to-Product Formulas **535**

Express Products as Sums • Express Sums as Products

Chapter Review	539
Chapter Test	542
Cumulative Review	543
Chapter Projects	544

8 Applications of Trigonometric Functions 545

8.1 Right Triangle Trigonometry; Applications	546
Find the Value of Trigonometric Functions of Acute Angles Using Right Triangles • Use the Complementary Angle Theorem • Solve Right Triangles • Solve Applied Problems	
8.2 The Law of Sines	559
Solve SAA or ASA Triangles • Solve SSA Triangles • Solve Applied Problems	
8.3 The Law of Cosines	570
Solve SAS Triangles • Solve SSS Triangles • Solve Applied Problems	
8.4 Area of a Triangle	577
Find the Area of SAS Triangles • Find the Area of SSS Triangles	
8.5 Simple Harmonic Motion; Damped Motion; Combining Waves	583
Build a Model for an Object in Simple Harmonic Motion • Analyze Simple Harmonic Motion • Analyze an Object in Damped Motion • Graph the Sum of Two Functions	
Chapter Review	593
Chapter Test	596
Cumulative Review	597
Chapter Projects	597

9 Polar Coordinates; Vectors 599

9.1 Polar Coordinates	600
Plot Points Using Polar Coordinates • Convert from Polar Coordinates to Rectangular Coordinates • Convert from Rectangular Coordinates to Polar Coordinates • Transform Equations between Polar and Rectangular Forms	
9.2 Polar Equations and Graphs	610
Identify and Graph Polar Equations by Converting to Rectangular Equations • Graph Polar Equations Using a Graphing Utility • Test Polar Equations for Symmetry • Graph Polar Equations by Plotting Points	
9.3 The Complex Plane; De Moivre's Theorem	627
Plot Points in the Complex Plane • Convert a Complex Number between Rectangular Form and Polar Form or Exponential Form • Find Products and Quotients of Complex Numbers • Use De Moivre's Theorem • Find Complex Roots	
9.4 Vectors	637
Graph Vectors • Find a Position Vector • Add and Subtract Vectors Algebraically • Find a Scalar Multiple and the Magnitude of a Vector • Find a Unit Vector • Find a Vector from Its Direction and Magnitude • Model with Vectors	
9.5 The Dot Product	651
Find the Dot Product of Two Vectors • Find the Angle between Two Vectors • Determine Whether Two Vectors Are Parallel • Determine Whether Two Vectors Are Orthogonal • Decompose a Vector into Two Orthogonal Vectors • Compute Work	

9.6 Vectors in Space 659

Find the Distance between Two Points in Space • Find Position Vectors in Space • Perform Operations on Vectors • Find the Dot Product • Find the Angle between Two Vectors • Find the Direction Angles of a Vector

9.7 The Cross Product 669

Find the Cross Product of Two Vectors • Know Algebraic Properties of the Cross Product • Know Geometric Properties of the Cross Product • Find a Vector Orthogonal to Two Given Vectors • Find the Area of a Parallelogram

Chapter Review 675

Chapter Test 678

Cumulative Review 679

Chapter Projects 679

10 Analytic Geometry 680**10.1 Conics 681**

Know the Names of the Conics

10.2 The Parabola 682

Analyze Parabolas with Vertex at the Origin • Analyze Parabolas with Vertex at (h, k) • Solve Applied Problems Involving Parabolas

10.3 The Ellipse 692

Analyze Ellipses with Center at the Origin • Analyze Ellipses with Center at (h, k) • Solve Applied Problems Involving Ellipses

10.4 The Hyperbola 705

Analyze Hyperbolas with Center at the Origin • Find the Asymptotes of a Hyperbola • Analyze Hyperbolas with Center at (h, k) • Solve Applied Problems Involving Hyperbolas

10.5 Rotation of Axes; General Form of a Conic 720

Identify a Conic • Use a Rotation of Axes to Transform Equations • Analyze an Equation Using a Rotation of Axes • Identify Conics without Rotating the Axes

10.6 Polar Equations of Conics 728

Analyze and Graph Polar Equations of Conics • Convert the Polar Equation of a Conic to a Rectangular Equation

10.7 Plane Curves and Parametric Equations 735

Graph Parametric Equations by Hand • Graph Parametric Equations Using a Graphing Utility • Find a Rectangular Equation for a Plane Curve Defined Parametrically • Use Time as a Parameter in Parametric Equations • Find Parametric Equations for Plane Curves Defined by Rectangular Equations

Chapter Review 749

Chapter Test 752

Cumulative Review 752

Chapter Projects 753

11 Systems of Equations and Inequalities 754**11.1 Systems of Linear Equations: Substitution and Elimination 755**

Solve Systems of Equations by Substitution • Solve Systems of Equations by Elimination • Identify Inconsistent Systems of Equations Containing Two Variables • Express the Solution of a System of Dependent Equations Containing Two Variables • Solve Systems of Three Equations Containing Three Variables • Identify Inconsistent Systems of Equations Containing Three Variables • Express the Solution of a System of Dependent Equations Containing Three Variables

11.2 Systems of Linear Equations: Matrices	769
Write the Augmented Matrix of a System of Linear Equations • Write the System of Equations from the Augmented Matrix • Perform Row Operations on a Matrix • Solve a System of Linear Equations Using Matrices	
11.3 Systems of Linear Equations: Determinants	784
Evaluate 2 by 2 Determinants • Use Cramer's Rule to Solve a System of Two Equations Containing Two Variables • Evaluate 3 by 3 Determinants • Use Cramer's Rule to Solve a System of Three Equations Containing Three Variables • Know Properties of Determinants	
11.4 Matrix Algebra	795
Find the Sum and Difference of Two Matrices • Find Scalar Multiples of a Matrix • Find the Product of Two Matrices • Find the Inverse of a Matrix • Solve a System of Linear Equations Using an Inverse Matrix	
11.5 Partial Fraction Decomposition	812
Decompose $\frac{P}{Q}$ where Q Has Only Nonrepeated Linear Factors	
• Decompose $\frac{P}{Q}$ where Q Has Repeated Linear Factors • Decompose $\frac{P}{Q}$ where Q Has a Nonrepeated Irreducible Quadratic Factor • Decompose $\frac{P}{Q}$ where Q Has a Repeated Irreducible Quadratic Factor	
11.6 Systems of Nonlinear Equations	821
Solve a System of Nonlinear Equations Using Substitution • Solve a System of Nonlinear Equations Using Elimination	
11.7 Systems of Inequalities	831
Graph an Inequality by Hand • Graph an Inequality Using a Graphing Utility • Graph a System of Inequalities	
11.8 Linear Programming	840
Set Up a Linear Programming Problem • Solve a Linear Programming Problem	
Chapter Review	847
Chapter Test	851
Cumulative Review	852
Chapter Projects	853

12 Sequences; Induction; the Binomial Theorem 854

12.1 Sequences	855
List the First Several Terms of a Sequence • List the Terms of a Sequence Defined by a Recursive Formula • Use Summation Notation • Find the Sum of a Sequence Algebraically and Using a Graphing Utility • Solve Annuity and Amortization Problems Using Recursive Formulas	
12.2 Arithmetic Sequences	869
Determine Whether a Sequence Is Arithmetic • Find a Formula for an Arithmetic Sequence • Find the Sum of an Arithmetic Sequence	
12.3 Geometric Sequences; Geometric Series	875
Determine Whether a Sequence Is Geometric • Find a Formula for a Geometric Sequence • Find the Sum of a Geometric Sequence • Determine Whether a Geometric Series Converges or Diverges • Solve Annuity Problems Using Formulas	
12.4 Mathematical Induction	887
Prove Statements Using Mathematical Induction	

12.5 The Binomial Theorem	891
Evaluate $\binom{n}{j}$ • Use the Binomial Theorem	
Chapter Review	898
Chapter Test	900
Cumulative Review	901
Chapter Projects	902

13 Counting and Probability 903

13.1 Counting	904
Find All the Subsets of a Set • Count the Number of Elements in a Set • Solve Counting Problems Using the Multiplication Principle	
13.2 Permutations and Combinations	909
Solve Counting Problems Using Permutations Involving n Distinct Objects • Solve Counting Problems Using Combinations • Solve Counting Problems Using Permutations Involving n Nondistinct Objects	
13.3 Probability	918
Construct Probability Models • Compute Probabilities of Equally Likely Outcomes • Find Probabilities of the Union of Two Events • Use the Complement Rule to Find Probabilities	
Chapter Review	928
Chapter Test	930
Cumulative Review	931
Chapter Projects	931

14 A Preview of Calculus: The Limit, Derivative, and Integral of a Function 933

14.1 Investigating Limits Using Tables and Graphs	934
Investigate a Limit Using a Table • Investigate a Limit Using a Graph	
14.2 Algebraic Techniques for Finding Limits	939
Find the Limit of a Sum, a Difference, and a Product • Find the Limit of a Polynomial • Find the Limit of a Power or a Root • Find the Limit of a Quotient • Find the Limit of an Average Rate of Change	
14.3 One-sided Limits; Continuity	946
Find the One-sided Limits of a Function • Determine Whether a Function Is Continuous at a Number	
14.4 The Tangent Problem; The Derivative	953
Find an Equation of the Tangent Line to the Graph of a Function • Find the Derivative of a Function • Find Instantaneous Rates of Change • Find the Instantaneous Velocity of an Object	
14.5 The Area Problem; The Integral	961
Approximate the Area under the Graph of a Function • Approximate Integrals Using a Graphing Utility	
Chapter Review	967
Chapter Test	971
Chapter Projects	972

Appendix A

Review

A1

A.1 Algebra Essentials

A1

Work with Sets • Graph Inequalities • Find Distance on the Real Number Line • Evaluate Algebraic Expressions • Determine the Domain of a Variable • Use the Laws of Exponents • Evaluate Square Roots • Use a Calculator to Evaluate Exponents

A.2 Geometry Essentials

A14

Use the Pythagorean Theorem and Its Converse • Know Geometry Formulas • Understand Congruent Triangles and Similar Triangles

A.3 Polynomials

A22

Recognize Monomials • Recognize Polynomials • Know Formulas for Special Products • Divide Polynomials Using Long Division • Factor Polynomials • Complete the Square

A.4 Synthetic Division

A31

Divide Polynomials Using Synthetic Division

A.5 Rational Expressions

A35

Reduce a Rational Expression to Lowest Terms • Multiply and Divide Rational Expressions • Add and Subtract Rational Expressions • Use the Least Common Multiple Method • Simplify Complex Rational Expressions

A.6 Solving Equations

A44

Solve Linear Equations • Solve Rational Equations • Solve Quadratic Equations by Factoring • Solve Quadratic Equations Using the Square Root Method • Solve Quadratic Equations by Completing the Square • Solve Quadratic Equations Using the Quadratic Formula • Solve Equations Quadratic in Form • Solve Absolute Value Equations • Solve Equations by Factoring

A.7 Complex Numbers; Quadratic Equations in the Complex Number System

A58

Add, Subtract, Multiply, and Divide Complex Numbers • Solve Quadratic Equations in the Complex Number System

A.8 Problem Solving: Interest, Mixture, Uniform Motion, Constant Rate Job Applications

A66

Translate Verbal Descriptions into Mathematical Expressions • Solve Interest Problems • Solve Mixture Problems • Solve Uniform Motion Problems • Solve Constant Rate Job Problems

A.9 Interval Notation; Solving Inequalities

A76

Use Interval Notation • Use Properties of Inequalities • Solve Inequalities • Solve Combined Inequalities • Solve Inequalities Involving Absolute Value

A.10 n th Roots; Rational Exponents

A87

Work with n th Roots • Simplify Radicals • Rationalize Denominators and Numerators • Solve Radical Equations • Simplify Expressions with Rational Exponents

Appendix B

The Limit of a Sequence; Infinite Series

B1

Answers

AN1

Challenge Problem Solutions

CP1

Photo Credits

C1

Subject Index

I1

Three Distinct Series to Meet Varied Instructional Needs

Students have different goals, learning styles, and levels of preparation. Instructors have different teaching philosophies, styles, and techniques. Rather than write one series to fit all, the Sullivans have written three distinct series. All share the same goal—to develop a high level of mathematical understanding and an appreciation for the way mathematics can describe the world around us. The manner of reaching that goal, however, differs from series to series.

Enhanced with Graphing Utilities Series

This series provides a thorough integration of graphing utilities into topics, allowing students to explore mathematical concepts and encounter ideas usually studied in later courses. Many examples show solutions using algebra side-by-side with graphing techniques. Using technology, the approach to solving certain problems differs from the Contemporary (Flagship) or Concepts through Functions Series, while the emphasis on understanding concepts and building strong skills is maintained. Texts in this series are *College Algebra*, *Algebra & Trigonometry*, and *Precalculus*.

Flagship Series

The Flagship Series is the most traditional in approach, yet modern in its treatment of precalculus mathematics. In each text, needed review material is included and is referenced when it is used. Graphing utility coverage is optional and can be included or excluded at the discretion of the instructor. Texts in this series are *College Algebra*, *Algebra & Trigonometry*, *Trigonometry: A Unit Circle Approach*, and *Precalculus*.

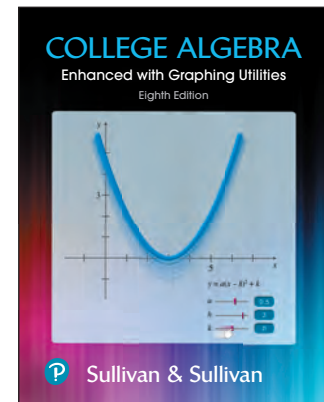
Concepts through Functions Series

This series differs from the others, utilizing a functions approach that serves as the organizing principle tying concepts together. Functions are introduced early in various formats. This approach supports the Rule of Four, which states that functions are represented symbolically, numerically, graphically, and verbally. Each chapter introduces a new type of function and then develops all concepts pertaining to that particular function. The solutions of equations and inequalities, instead of being developed as stand-alone topics, are developed in the context of the underlying functions. Graphing utility coverage is optional and can be included or excluded at the discretion of the instructor. Texts in this series are *College Algebra*; *Precalculus, with a Unit Circle Approach to Trigonometry*; *Precalculus, with a Right Triangle Approach to Trigonometry*.

The Enhanced with Graphing Utilities Series

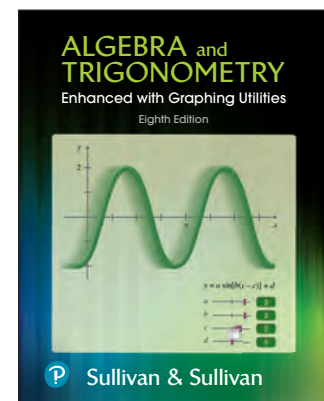
College Algebra, Eighth Edition

This text provides an approach to college algebra that completely integrates graphing technology without sacrificing mathematical analysis and conceptualization. The text has three chapters of review material preceding the chapter on functions. Graphing calculator usage is integrated throughout. After completing this text, a student will be prepared for trigonometry, finite mathematics, and business calculus.



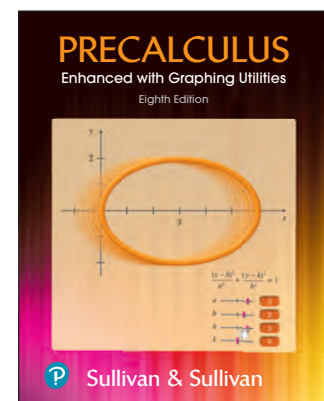
Algebra & Trigonometry, Eighth Edition

This text contains all the material in *College Algebra*, but it also develops the trigonometric functions using a right triangle approach and shows how that approach is related to the unit circle approach. Graphing techniques are emphasized, including a thorough discussion of polar coordinates, parametric equations, and conics using polar coordinates. Vectors in the plane, including the dot product, sequences, induction, and the binomial theorem are also presented. After completing this text, a student will be prepared for finite mathematics, business calculus, and engineering calculus.



Precalculus, Eighth Edition

This text contains a review chapter before covering the traditional precalculus topics of functions and their graphs, polynomial and rational functions, and exponential and logarithmic functions. The trigonometric functions are introduced using a unit circle approach and show how it is related to the right triangle approach. Graphing techniques are emphasized, including a thorough discussion of polar coordinates, parametric equations, and conics using polar coordinates. Vectors in the plane and in space, including the dot and cross products, sequences, induction, and the binomial theorem are also presented. Graphing calculator usage is integrated throughout. The final chapter provides an introduction to calculus, with a discussion of the limit, the derivative, and the integral of a function. After completing this text, a student will be prepared for finite mathematics, business calculus, and engineering calculus.



Preface to the Instructor

As professors at an urban university (Michael Sullivan) and a community college (Michael Sullivan III), we are aware of the varied needs of students in this course. Such students range from those who have little mathematical background and are fearful of mathematics courses to those with a strong mathematical education and a high level of motivation. For some of your students, this will be their last course in mathematics, whereas others will further their mathematical education. We have written this text with both groups in mind.

As a teacher, and as an author of precalculus, engineering calculus, finite mathematics, and business calculus texts, Michael Sullivan understands what students must know if they are to be focused and successful in upper-level math courses. As an instructor and an author of a developmental mathematics series, Michael's son and co-author, Michael Sullivan III, understands the trepidations and skills that students bring to the Precalculus course. As the father of current college students, Michael III realizes that today's college students demand a variety of media to support their education. This text addresses that demand by providing technology and video support that enhances understanding without sacrificing math skills. Together, we have taken great pains to ensure that the text offers solid, student-friendly examples and problems, as well as a clear and seamless writing style.

A tremendous benefit of authoring a successful series is the broad-based feedback we receive from teachers and students. We are sincerely grateful for their support. Virtually every change in this edition is the result of their thoughtful comments and suggestions. We are confident that, building on the success of the first seven editions and incorporating many of these suggestions, we have made *Precalculus Enhanced with Graphing Utilities*, 8th Edition, an even better tool for learning and teaching. We continue to encourage you to share with us your experiences teaching from this text.



Features in the Eighth Edition

A descriptive list of the many special features of *Precalculus* can be found in the front of this text. This list places the features in their proper context as building blocks of an overall learning system that has been carefully crafted over the years to help students get the most out of the time they put into studying. Please take the time to review this and to discuss it with your students at the beginning of your course. Our experience is that when students utilize these features, they are more successful in the course.

New to the Eighth Edition

New Within the Textbook

All of the exercises and examples in the text have been reviewed and analyzed, and we have incorporated feedback from users of the text. All time-sensitive problems have been updated to the most recent information available. Here are the new features of this edition:

- **Challenge Problems** – These problems appear in the Applications and Extensions part of the section exercises and are designed to challenge students. Full solutions are in the back of the Annotated Instructor's Edition and in the Instructor's Solution Manual.
- **"Need to Review?" feature** – We placed reminders in the margin for key review topics. The reminders point students to the location of the review material in the textbook.
- **Chapter Projects** – The projects have been enhanced to give students an up-to-the-minute experience. Many of these projects require the student to research information online in order to solve problems.
- **Interactive Figure Exercises** – We have added this new category of exercises that require students to manipulate an interactive figure to solve. The interactive figures may be found at bit.ly/2Mibga0 or in the Video and Resource Library of MyLab Math, and were created by author Michael Sullivan III in GeoGebra. These exercises are labeled with the icon .
- **Expanded! Retain Your Knowledge Problems** – These problems, which were new to the previous edition, are based on learning research, including a study of precalculus students at University of Louisville entitled "Spaced retrieval practice increases college students' short- and long-term retention of mathematics knowledge" (Hopkins et al, 2016). The Retain Your Knowledge problems were so well received that we have expanded them in this edition. Moreover, while the focus remains to help students maintain their skills, in most sections, problems were chosen that preview skills required to succeed in subsequent sections or in calculus (). All answers to Retain Your Knowledge problems are given in the back of the text and these problems are available in the prebuilt assignments in the Assignment Manager in MyLab Math.
- **Key to Exercise Types** – To help you navigate the features of the exercise sets, we've included a key at the bottom of the first page of each section's exercises.

 **Now Work**  **1. Modeling** **1. Writing/Discussion**
 **Calculus Preview**  **Interactive Figure**

- **Graphing Utility Screen Captures** – In several instances we have added Desmos screen captures along with the TI-84 Plus CE screen captures. These updated screen captures provide alternative ways of visualizing concepts and making connections between equations, data, and graphs in full color.

Content Changes

Chapter 1

- Section 1.1 has been reorganized to only include an introduction to graphing and graphing utilities.
- NEW Section 1.2 The Distance and Midpoint Formulas
- NEW Section 1.3 Example 5 Testing an Equation for Symmetry

Chapter 2

- NEW Section 2.1 Objective 1 Describe a Relation
 - NEW Example 1 Describing a Relation demonstrates using the Rule of Four to express a relation numerically, as a mapping, and graphically given a verbal description.
- NEW Section 2.2 Example 4 Energy Expended

Chapter 3

- Section 3.3 now introduces the concept of concavity for a quadratic function.
- NEW Section 3.3 Example 3 Graphing a Quadratic Function Using Its Vertex, Axis, and Intercepts
- Section 3.3 Example 8 Analyzing the Motion of a Projectile (formerly in Section 3.4)
- NEW Section 3.4 Example 4 Fitting a Quadratic Function to Data

Chapter 4

- Previous Section 4.1 has been revised and split into two sections:
 - 4.1 Polynomial Functions
 - 4.2 Graphing Polynomial Functions; Models
- NEW Section 4.2 Example 2 Graphing a Polynomial Function (a 4th degree polynomial function)

Chapter 5

- NEW Section 5.2 Objective Verify a Function Defined by an Equation is an Inverse Function

Chapter 6

- NEW Section 6.1 Example 6 Field Width of a Digital Lens Reflex Camera Lens
- Sections 6.4 and 6.5 were reorganized for increased clarity. Two new objectives were added to Section 6.5.

Chapter 7

- Sections 7.1 and 7.2 were reorganized for increased clarity. Four new objectives were added to Section 7.1. The objectives in Section 7.2 were reordered.

Chapter 9

- Section 9.3 DeMoivre's Theorem was rewritten to support the exponential form of a complex number.
 - Euler's Formula is introduced to express a complex number in exponential form. The exponential form is used to compute products and quotients.
 - DeMoivre's Theorem is expressed using the exponential form of a complex number. The exponential form is used to find complex roots.

Chapter 11

- NEW Section 11.5 Example 1 Identifying Proper and Improper Rational Expressions

Chapter 12

- NEW Section 12.3 Objective 5 Solving Annuity Problems Using Formulas

Appendix A

- Section A.10 Objective 3 now includes rationalizing the numerator. Problems 69–76 provide practice.

New Within MyLab Math

- **Setup & Solve Exercises** require students to show how they set up a problem as well as the solution, better mirroring what is required of them on tests. We have included both the “traditional” and Setup & Solve versions of exercise within MyLab to provide you with more options for assessing students.
- **Integrated Review** content and assessments help you provide students with the remediation they need, when they need it. Integrated Review consists of:
 - **Skills Check Quizzes** by chapter assess the prerequisite skills students need for that chapter.
 - **Skills Review Homework**, again by chapter, is personalized (based on the results of the Skills Check Quiz) to provide students with help on the prerequisite skills they are lacking. Students receive just the help they need—no more, no less.
 - **Intermediate Algebra eText, Exercises, Videos, and Worksheets**—For students who need more help (or for co-requisite courses), we've included the contents of a streamlined Intermediate Algebra course within this MyLab course. There's no need to go elsewhere for remediation.
- **Interactive Figures** (formerly titled Guided Visualizations) have been expanded to support teaching and learning. The figures (created in GeoGebra by author Michael Sullivan III) illustrate key concepts and allow manipulation. They have been designed to be used in lecture as well as by students independently.
- **Enhanced Sample Assignments** are pre-made section-level assignments that address key concepts within the section and help keep previously learned skills fresh with Retain Your Knowledge questions. They are assignable and editable.

Chapter 12 Sequences; Induction; The Binomial Theorem

There are three independent parts: Sections 12.1–12.3, Section 12.4, and Section 12.5.

The sections follow in sequence.

If time permits, coverage of this chapter will provide your students with a beneficial head start in calculus. The sections follow in sequence.

This appendix consists of review material. It may be used as the first part of the course or later as a just-in-time review when the content is required. Specific references to this appendix occur throughout the text to assist in the review process.

This section represents a more thorough treatment of sequences and series.

Texts are written by authors, but they evolve from idea to final form through the efforts of many people.

Thanks are due to the following people for their assistance and encouragement during the preparation of this edition:

- From Pearson Education: Dawn Murrin, for her substantial support, dedication, and energy; Jeff Weidenaar for his attention to detail, experience, editorial expertise, and genuine interest in this project; Peggy McMahon for directing the always difficult production process; Rose Kernan for handling liaison between the compositor and author; Stacey Sveum and Jordan of Longoria for their creative and enthusiastic marketing this text; Marcia Horton for her continued support and genuine interest; Paul Corey for his leadership and commitment to excellence; and Peggy Lucas and the Pearson sales team for their continued confidence and personal support of our texts.
- Accuracy checkers: Roger Lipsett read the entire manuscript and checked the accuracy of answers. Timothy Britt created the Solutions Manuals and accuracy-checked answers.
- Michael Sullivan III would like to thank his colleagues at Joliet Junior College for their support and feedback.

Finally, we offer our sincere thanks to the dedicated users and reviewers of our texts, whose collective insights form the backbone of each text revision.

The list of those to whom we are indebted continues to grow. If we've forgotten anyone, please accept our apology. Thank you to all.



A quick coverage of this chapter, which is mainly review material, will enable you to get to Chapter 2, “Functions and Their Graphs,” earlier.

This is perhaps the most important chapter. Section 2.6 is optional.

Topic selection depends on your syllabus. Sections 3.2 and 3.4 may be omitted without loss of continuity.

Topic selection depends on your syllabus.

Sections 5.1–5.6 follow in sequence. Sections 5.7, 5.8, and 5.9 are optional.

Section 6.6 may be omitted in a brief course.

Sections 7.2 and 7.7 may be omitted in a brief course.

Sections 8.4 and 8.5 may be omitted in a brief course.

Sections 9.1–9.3 and Sections 9.4–9.7 are independent and may be covered separately.

Sections 10.1–10.4 follow in sequence. Sections 10.5, 10.6, and 10.7 are independent of each other, but each requires Sections 10.1–10.4.

Sections 11.2–11.7 may be covered in any order, but each requires Section 11.1. Section 11.8 requires Section 11.7.

xxiv Preface to the Instructor

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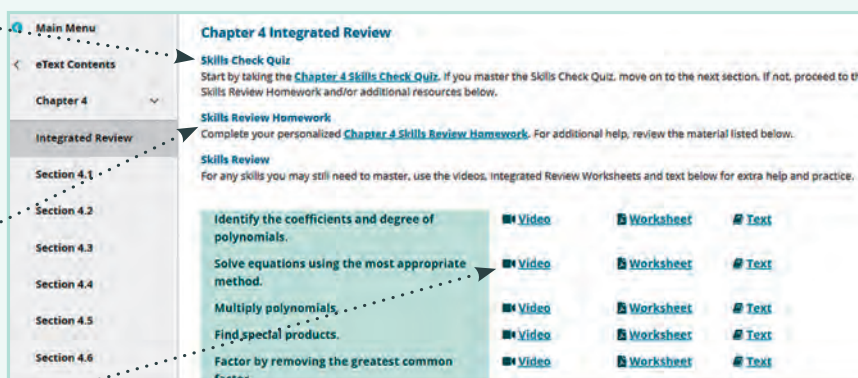
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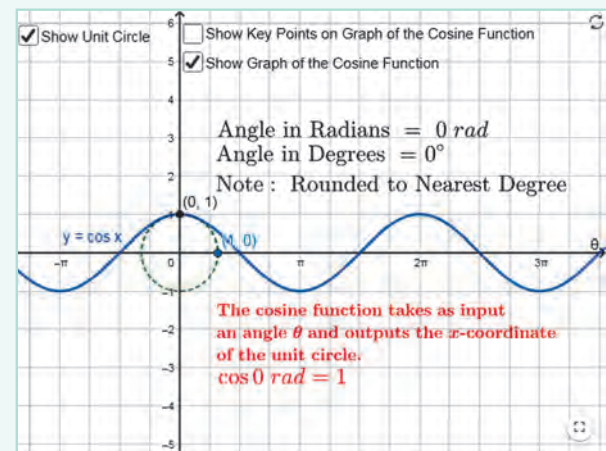
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<input type="checkbox"/>	<input type="checkbox"/>	R	Chapter 3 Skills Review Homework (Integrated Review)	Chapter 3 Skills Review Homework (Integrated Review)
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