

CHAPTER 1	Review	1
	1.1 Exponents. 1.2 Polynomials. 1.3 Equations: Linear and Quadratic. 1.4 Simultaneous Equations. 1.5 Functions. 1.6 Graphs, Slopes, and Intercepts.	
CHAPTER 2	Economic Applications of Graphs and Equations	14
	2.1 Isocost Lines. 2.2 Supply and Demand Analysis. 2.3 Income Determination Models. 2.4 <i>IS-LM</i> Analysis.	
CHAPTER 3	The Derivative and the Rules of Differentiation	32
	3.1 Limits. 3.2 Continuity. 3.3 The Slope of a Curvilinear Function. 3.4 The Derivative. 3.5 Differentiability and Continuity. 3.6 Derivative Notation. 3.7 Rules of Differentiation. 3.8 Higher-Order Derivatives. 3.9 Implicit Differentiation.	
CHAPTER 4	Uses of the Derivative in Mathematics and Economics	58
	4.1 Increasing and Decreasing Functions. 4.2 Concavity and Convexity. 4.3 Relative Extrema. 4.4 Inflection Points. 4.5 Optimization of Functions. 4.6 Successive-Derivative Test for Optimization. 4.7 Marginal Concepts. 4.8 Optimizing Economic Functions. 4.9 Relationship among Total, Marginal, and Average Concepts.	
CHAPTER 5	Calculus of Multivariable Functions	82
	5.1 Functions of Several Variables and Partial Derivatives. 5.2 Rules of Partial Differentiation. 5.3 Second-Order Partial Derivatives. 5.4 Optimization of Multivariable Functions. 5.5 Constrained Optimization with Lagrange Multipliers. 5.6 Significance of the Lagrange Multiplier. 5.7 Differentials. 5.8 Total and Partial Differentials. 5.9 Total Derivatives. 5.10 Implicit and Inverse Function Rules.	
CHAPTER 6	Calculus of Multivariable Functions in Economics	110
	6.1 Marginal Productivity. 6.2 Income Determination Multipliers and Comparative Statics. 6.3 Income and Cross Price Elasticities of Demand. 6.4 Differentials and Incremental Changes. 6.5 Optimization of Multivariable Functions in Economics. 6.6 Constrained Optimization of Multivariable	

Functions in Economics. **6.7** Homogeneous Production Functions. **6.8** Returns to Scale. **6.9** Optimization of Cobb-Douglas Production Functions. **6.10** Optimization of Constant Elasticity of Substitution Production Functions.

CHAPTER 7 Exponential and Logarithmic Functions 146

7.1 Exponential Functions. **7.2** Logarithmic Functions. **7.3** Properties of Exponents and Logarithms. **7.4** Natural Exponential and Logarithmic Functions. **7.5** Solving Natural Exponential and Logarithmic Functions. **7.6** Logarithmic Transformation of Nonlinear Functions.

CHAPTER 8 Exponential and Logarithmic Functions in Economics 160

8.1 Interest Compounding. **8.2** Effective vs. Nominal Rates of Interest. **8.3** Discounting. **8.4** Converting Exponential to Natural Exponential Functions. **8.5** Estimating Growth Rates from Data Points.

CHAPTER 9 Differentiation of Exponential and Logarithmic Functions 173

9.1 Rules of Differentiation. **9.2** Higher-Order Derivatives. **9.3** Partial Derivatives. **9.4** Optimization of Exponential and Logarithmic Functions. **9.5** Logarithmic Differentiation. **9.6** Alternative Measures of Growth. **9.7** Optimal Timing. **9.8** Derivation of a Cobb-Douglas Demand Function Using a Logarithmic Transformation.

CHAPTER 10 The Fundamentals of Linear (or Matrix) Algebra 199

10.1 The Role of Linear Algebra. **10.2** Definitions and Terms. **10.3** Addition and Subtraction of Matrices. **10.4** Scalar Multiplication. **10.5** Vector Multiplication. **10.6** Multiplication of Matrices. **10.7** Commutative, Associative, and Distributive Laws in Matrix Algebra. **10.8** Identity and Null Matrices. **10.9** Matrix Expression of a System of Linear Equations.

CHAPTER 11 Matrix Inversion 224

11.1 Determinants and Nonsingularity. **11.2** Third-Order Determinants. **11.3** Minors and Cofactors. **11.4** Laplace Expansion and Higher-Order Determinants. **11.5** Properties of a Determinant. **11.6** Cofactor and Adjoint Matrices. **11.7** Inverse Matrices. **11.8** Solving Linear Equations with the Inverse. **11.9** Cramer's Rule for Matrix Solutions.

CHAPTER 12	Special Determinants and Matrices and Their Use in Economics	254
	12.1 The Jacobian. 12.2 The Hessian. 12.3 The Discriminant. 12.4 Higher-Order Hessians. 12.5 The Bordered Hessian for Constrained Optimization. 12.6 Input-Output Analysis. 12.7 Characteristic Roots and Vectors (Eigenvalues, Eigenvectors).	
CHAPTER 13	Comparative Statics and Concave Programming	284
	13.1 Introduction to Comparative Statics. 13.2 Comparative Statics with One Endogenous Variable. 13.3 Comparative Statics with More Than One Endogenous Variable. 13.4 Comparative Statics for Optimization Problems. 13.5 Comparative Statics Used in Constrained Optimization. 13.6 The Envelope Theorem. 13.7 Concave Programming and Inequality Constraints.	
CHAPTER 14	Integral Calculus: The Indefinite Integral	326
	14.1 Integration. 14.2 Rules of Integration. 14.3 Initial Conditions and Boundary Conditions. 14.4 Integration by Substitution. 14.5 Integration by Parts. 14.6 Economic Applications.	
CHAPTER 15	Integral Calculus: The Definite Integral	342
	15.1 Area Under a Curve. 15.2 The Definite Integral. 15.3 The Fundamental Theorem of Calculus. 15.4 Properties of Definite Integrals. 15.5 Area Between Curves. 15.6 Improper Integrals. 15.7 L'Hôpital's Rule. 15.8 Consumers' and Producers' Surplus. 15.9 The Definite Integral and Probability.	
CHAPTER 16	First-Order Differential Equations	362
	16.1 Definitions and Concepts. 16.2 General Formula for First-Order Linear Differential Equations. 16.3 Exact Differential Equations and Partial Integration. 16.4 Integrating Factors. 16.5 Rules for the Integrating Factor. 16.6 Separation of Variables. 16.7 Economic Applications. 16.8 Phase Diagrams for Differential Equations.	
CHAPTER 17	First-Order Difference Equations	391
	17.1 Definitions and Concepts. 17.2 General Formula for First-Order Linear Difference Equations. 17.3 Stability Conditions. 17.4 Lagged Income Determination Model. 17.5 The Cobweb Model. 17.6 The Harrod Model. 17.7 Phase Diagrams for Difference Equations.	

**Second-Order Differential Equations and
Difference Equations**

408

18.1 Second-Order Differential Equations. **18.2** Second-Order Difference Equations. **18.3** Characteristic Roots.
18.4 Conjugate Complex Numbers. **18.5** Trigonometric Functions. **18.6** Derivatives of Trigonometric Functions.
18.7 Transformation of Imaginary and Complex Numbers.
18.8 Stability Conditions.

Simultaneous Differential and Difference Equations 428

19.1 Matrix Solution of Simultaneous Differential Equations, Part 1. **19.2** Matrix Solution of Simultaneous Differential Equations, Part 2. **19.3** Matrix Solution of Simultaneous Difference Equations, Part 1. **19.4** Matrix Solution of Simultaneous Difference Equations, Part 2. **19.5** Stability and Phase Diagrams for Simultaneous Differential Equations.

The Calculus of Variations

460

20.1 Dynamic Optimization. **20.2** Distance Between Two Points on a Plane. **20.3** Euler's Equation and the Necessary Condition for Dynamic Optimization. **20.4** Finding Candidates for Extremals. **20.5** The Sufficiency Conditions for the Calculus of Variations. **20.6** Dynamic Optimization Subject to Functional Constraints. **20.7** Variational Notation.
20.8 Applications to Economics.

Optimal Control Theory

493

21.1 Terminology. **21.2** The Hamiltonian and the Necessary Conditions for Maximization in Optimal Control Theory.
21.3 Sufficiency Conditions for Maximization in Optimal Control. **21.4** Optimal Control Theory with a Free Endpoint. **21.5** Inequality Constraints in the Endpoints.
21.6 The Current-Valued Hamiltonian.