Preface	ix
1 Introductory Topics I: Algebi	ra 1
1.1 The Real Numbers	1
1.2 Integer Powers	4
1.3 Rules of Algebra	10
1.4 Fractions	15
1.5 Fractional Powers	19
1.6 Inequalities	24
1.7 Intervals and Absolute Values	29
Review Problems for Chapter 1	32
2 Introductory Topics II:	
Equations	35
2.1 How to Solve Simple Equations	35
2.2 Equations with Parameters	38
2.3 Quadratic Equations	41
2.4 Linear Equations in Two Unknowns	46
2.5 Nonlinear Equations	48
Review Problems for Chapter 2	49
3 Introductory Topics III:	
Miscellaneous	51
3.1 Summation Notation	51
3.2 Rules for Sums. Newton's Binomial	
Formula	55

3.3	Double Sums	39
3.4	A Few Aspects of Logic	61
3.5	Mathematical Proofs	67
3.6	Essentials of Set Theory	69
3.7	Mathematical Induction	74
	Review Problems for Chapter 3	76
4 Fi	unctions of One Variable	79
4.1	Introduction	79
4.2	Basic Definitions	80
4.3	Graphs of Functions	86
4.4	Linear Functions	89
4.5	Linear Models	96
4.6	Quadratic Functions	99
4.7	Polynomials	105
4.8	Power Functions	112
4.9	Exponential Functions	114
4.10	Logarithmic Functions	120
	Review Problems for Chapter 4	124
5 Pr	operties of Functions	127
5.1	Shifting Graphs	127
5.2	New Functions from Old	132
5.3	Inverse Functions	136
5.4	Graphs of Equations	143
5.5	Distance in the Plane. Circles	146

5.6 General Functions	150
Review Problems for Chapter 5	153
6 Differentiation	155
6.1 Slopes of Curves	155
6.2 The Derivative. Tangents	157
6.3 Increasing and Decreasing Functions	163
6.4 Rates of Change	165
6.5 A Dash of Limits	169
6.6 Simple Rules for Differentiation	174
6.7 Sums, Products, and Quotients	178
6.8 Chain Rule	184
6.9 Higher-Order Derivatives	189
6.10 Exponential Functions	194
6.11 Logarithmic Functions	197
Review Problems for Chapter 6	203
7 Derivatives in Use	205
7.1 Implicit Differentiation	205
7.2 Economic Examples	210
7.3 Differentiating the Inverse	213
7.4 Linear Approximations	216
7.5 Polynomial Approximations	221
7.6 Taylor's Formula	224
7.7 Why Economists Use Elasticities	228
7.8 Continuity	232
7.9 More on Limits	236
7.10 Intermediate Value Theorem.	
Newton's Method	244
7.11 Infinite Sequences	248
7.12 L'Hôpital's Rule	250
Review Problems for Chapter 7	254
8 Single-Variable	
Optimization	257
8.1 Introduction	257
8.2 Simple Tests for Extreme Points	260
8.3 Economic Examples	264
8.4 The Extreme Value Theorem	268
8.5 Further Economic Examples	274
8.6 Local Extreme Points	279
8.7 Inflection Points	285
Review Problems for Chapter 8	289

9 Integration	291
9.1 Indefinite Integrals	291
9.2 Area and Definite Integrals	297
9.3 Properties of Definite Integrals	303
9.4 Economic Applications	306
9.5 Integration by Parts	313
9.6 Integration by Substitution	316
9.7 Infinite Intervals of Integration	319
9.8 A Glimpse at Differential Equations	326
9.9 Separable and Linear Differential	
Equations	331
Review Problems for Chapter 9	336
10 Interest Rates and	
Present Values	339
10.1 Interest Periods and Effective Rates	339
10.2 Continuous Compounding	343
10.3 Present Value	345
10.4 Geometric Series	347
10.5 Total Present Value	352
10.6 Mortgage Repayments	357
10.7 Internal Rate of Return	362
10.8 A Glimpse at Difference Equations	363
Review Problems for Chapter 10	367
11 Functions of Many	
Variables	369
11.1 Functions of Two Variables	369
11.2 Partial Derivatives with Two Variable	s 373
11.3 Geometric Representation	379
11.4 Surfaces and Distance	386
11.5 Functions of More Variables	389
11.6 Partial Derivatives with More Variable	
11.7 Economic Applications	396
11.8 Partial Elasticities	398
Review Problems for Chapter 11	400
12 Tools for Comparative	
Statics	403
12.1 A Simple Chain Rule	403
12.2 Chain Rules for Many Variables	408
12.3 Implicit Differentiation along	
a Level Curve	412
12.4 More General Cases	416

12.5 Elasticity of Substitution	420
12.6 Homogeneous Functions of	
Two Variables	423
12.7 General Homogeneous and Homothetic	
Functions	427
12.8 Linear Approximations	432
12.9 Differentials	436
12.10 Systems of Equations	441
12.11 Differentiating Systems of Equations	444
Review Problems for Chapter 12	450
13 Multivariable	
Optimization	453
13.1 Two Variables: Necessary Conditions	453
13.2 Two Variables: Sufficient Conditions	458
13.3 Local Extreme Points	462
13.4 Linear Models with Quadratic	
Objectives	467
13.5 The Extreme Value Theorem	474
13.6 Three or More Variables	479
13.7 Comparative Statics and	
the Envelope Theorem	482
Review Problems for Chapter 13	486
14 Constrained Optimization	1 89
14.1 The Lagrange Multiplier Method	489
14.2 Interpreting the Lagrange Multiplier	496
14.3 Several Solution Candidates	499
14.4 Why the Lagrange Multiplier Method	
Works	501
14.5 Sufficient Conditions	505
14.6 More Variables and More Constraints	
14.7 Componenting Station	508
14.7 Comparative Statics	514
14.7 Comparative Statics 14.8 Nonlinear Programming: A Simple Case	514 517
-	514
14.8 Nonlinear Programming: A Simple Case	514 517
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector 	514 517 523 530
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector 	514 517 523
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector 	514 517 523 530
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector Algebra 	514 517 523 530
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector Algebra 15.1 Systems of Linear Equations 	514 517 523 530 533
 14.8 Nonlinear Programming: A Simple Case 14.9 More on Nonlinear Programming Review Problems for Chapter 14 15 Matrix and Vector Algebra 15.1 Systems of Linear Equations 15.2 Matrices and Matrix Operations 	514 517 523 530 533 533 537

15.7 Vectors		559
15.8 Geometric Interp	retation of Vectors	562
15.9 Lines and Planes		567
Review Problem	s for Chapter 15	571
16 Determinan		
Inverse Mat	rices	573
16.1 Determinants of	Order 2	573
16.2 Determinants of	Order 3	576
16.3 Determinants of	Order n	580
16.4 Basic Rules for I	Determinants	583
16.5 Expansion by Co		588
16.6 The Inverse of a		591
16.7 A General Form	ıla for the Inverse	597
16.8 Cramer's Rule		600
16.9 The Leontief Mo		603
Review Problem	s for Chapter 16	607
17 Linear Progr	ramming 6	509
17.1 A Graphical App	roach	609
17.2 Introduction to E		615
17.3 The Duality The		619
		012
		622
17.4 A General Econo	mic Interpretation	
	omic Interpretation Slackness	622
17.4 A General Econo17.5 Complementary	omic Interpretation Slackness s for Chapter 17	622 624
17.4 A General Econo17.5 ComplementaryReview Problem	omic Interpretation Slackness s for Chapter 17 metry	622 624 629
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo	omic Interpretation Slackness s for Chapter 17 metry abet	622 624 629 631
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo The Greek Alph	omic Interpretation Slackness s for Chapter 17 metry abet	622 624 629 531
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo The Greek Alph	metry eabet Problems	622 624 629 631
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo The Greek Alph Answers to the	metry eabet Problems	622 624 629 631 633
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo The Greek Alph Answers to the	metry eabet Problems	622 624 629 631 633
17.4 A General Econo 17.5 Complementary Review Problem Appendix: Geo The Greek Alph Answers to the	metry eabet Problems	622 624 629 631 633

15.6 Gaussian Elimination

554