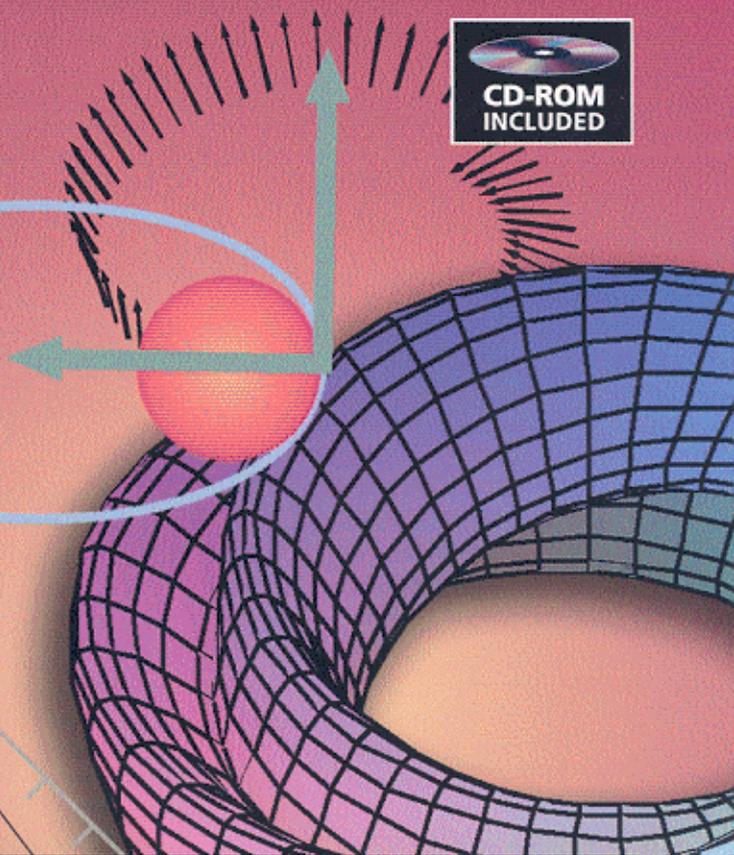
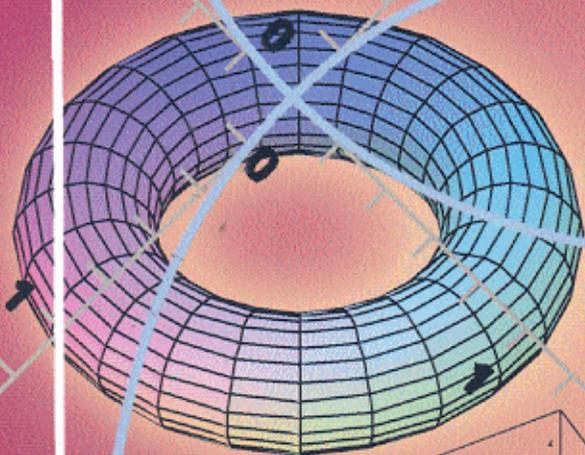


MAPLE

by **EXAMPLE**

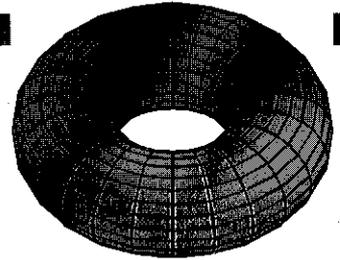
3

RD EDITION



MARTHA L. ABELL and JAMES B. BRASELTON

Contents



Preface	ix
1 Getting Started	1
1.1 Introduction to Maple	1
A Note Regarding Different Versions of Maple	2
1.1.1 Getting Started with Maple	3
Preview	7
1.2 Loading Packages	8
1.3 Getting Help from Maple	11
Maple Help	13
The Maple Menu	15
2 Basic Operations on Numbers, Expressions, and Functions	19
2.1 Numerical Calculations and Built-In Functions	19
2.1.1 Numerical Calculations	19
2.1.2 Built-In Constants	22
2.1.3 Built-In Functions	23
A Word of Caution	26
2.2 Expressions and Functions: Elementary Algebra	27
2.2.1 Basic Algebraic Operations on Expressions	27
2.2.2 Naming and Evaluating Expressions	31
Two Words of Caution	33
2.2.3 Defining and Evaluating Functions	33
2.3 Graphing Functions, Expressions, and Equations	40
2.3.1 Functions of a Single Variable	40
2.3.2 Parametric and Polar Plots in Two Dimensions	51

2.3.3	Three-Dimensional and Contour Plots; Graphing Equations	57
2.3.4	Parametric Curves and Surfaces in Space	66
2.4	Solving Equations and Inequalities	73
2.4.1	Exact Solutions of Equations	73
2.4.2	Solving Inequalities	82
2.4.3	Approximate Solutions of Equations	84
3	Calculus	91
3.1	Limits	91
3.1.1	Using Graphs and Tables to Predict Limits	91
3.1.2	Computing Limits	93
3.1.3	One-Sided Limits	96
3.2	Differential Calculus	98
3.2.1	Definition of the Derivative	98
3.2.2	Calculating Derivatives	102
3.2.3	Implicit Differentiation	105
3.2.4	Tangent Lines	105
3.2.5	The First Derivative Test and Second Derivative Test	116
3.2.6	Applied Max/Min Problems	121
3.2.7	Antidifferentiation	131
3.3	Integral Calculus	134
3.3.1	Area	134
3.3.2	The Definite Integral	139
3.3.3	Approximating Definite Integrals	144
3.3.4	Area	148
3.3.5	Arc Length	154
3.3.6	Solids of Revolution	158
3.4	Series	164
3.4.1	Introduction to Sequences and Series	164
3.4.2	Convergence Tests	170
3.4.3	Alternating Series	174
3.4.4	Power Series	176
3.4.5	Taylor and Maclaurin Series	179
3.4.6	Taylor's Theorem	185
3.4.7	Other Series	188
3.5	Multi-Variable Calculus	190
3.5.1	Limits of Functions of Two Variables	190
3.5.2	Partial and Directional Derivatives	193
3.5.3	Iterated Integrals	212
4	Introduction to Lists and Tables	223
4.1	Lists and List Operations	223

4.1.1	Defining Lists	223
4.1.2	Plotting Lists of Points	227
4.2	Manipulating Lists: More on <code>op</code> and <code>map</code>	238
4.2.1	More on Graphing Lists	247
4.3	Mathematics of Finance	253
4.3.1	Compound Interest	254
4.3.2	Future Value	256
4.3.3	Annuity Due	257
4.3.4	Present Value	259
4.3.5	Deferred Annuities	260
4.3.6	Amortization	262
4.3.7	More on Financial Planning	267
4.4	Other Applications	274
4.4.1	Approximating Lists with Functions	274
4.4.2	Introduction to Fourier Series	281
4.4.3	The Mandelbrot Set and Julia Sets	294
5	Matrices and Vectors: Topics from Linear Algebra and Vector Calculus	311
5.1	Nested Lists: Introduction to Matrices, Vectors, and Matrix Operations	312
5.1.1	Defining Nested Lists, Matrices, and Vectors	312
5.1.2	Extracting Elements of Matrices	320
5.1.3	Basic Computations with Matrices	322
5.1.4	Basic Computations with Vectors	328
5.2	Linear Systems of Equations	336
5.2.1	Calculating Solutions of Linear Systems of Equations	336
5.2.2	Gauss-Jordan Elimination	342
5.3	Selected Topics from Linear Algebra	349
5.3.1	Fundamental Subspaces Associated with Matrices	349
5.3.2	The Gram-Schmidt Process	352
5.3.3	Linear Transformations	355
5.3.4	Eigenvalues and Eigenvectors	360
5.3.5	Jordan Canonical Form	365
5.3.6	The QR Method	369
5.4	Maxima and Minima Using Linear Programming	372
5.4.1	The Standard Form of a Linear Programming Problem	372
5.4.2	The Dual Problem	375
5.5	Selected Topics from Vector Calculus	384
5.5.1	Vector-Valued Functions	384
5.5.2	Line Integrals	397
5.5.3	Surface Integrals	401
5.5.4	A Note on Nonorientability	406

6 Applications Related to Ordinary and Partial Differential Equations	417
6.1 First-Order Differential Equations	417
6.1.1 Separable Equations	417
6.1.2 Linear Equations	422
6.1.3 Nonlinear Equations	433
6.1.4 Numerical Methods	437
6.2 Second-Order Linear Equations	443
6.2.1 Basic Theory	443
6.2.2 Constant Coefficients	444
6.2.3 Undetermined Coefficients	452
6.2.4 Variation of Parameters	457
6.3 Higher-Order Linear Equations	460
6.3.1 Basic Theory	460
6.3.2 Constant Coefficients	460
6.3.3 Undetermined Coefficients	463
6.3.4 Laplace Transform Methods	473
6.3.5 Nonlinear Higher-Order Equations	486
6.4 Systems of Equations	487
6.4.1 Linear Systems	487
6.4.2 Nonhomogeneous Linear Systems	498
6.4.3 Nonlinear Systems	502
6.5 Some Partial Differential Equations	518
6.5.1 The One-Dimensional Wave Equation	519
6.5.2 The Two-Dimensional Wave Equation	524
6.5.3 Other Partial Differential Equations	534
Bibliography	539
Subject Index	541