

Contents

Preface	vii
Conventions and Notation	xiii
1 Number Theory	1
1.1 Introduction to <i>Maple</i>	1
1.1.1 Inputting Basic <i>Maple</i> Expressions	1
1.1.2 Variables	3
1.1.3 Functions	5
1.1.4 Sequences, Lists, and Sets	6
1.1.5 Sums and Products	9
1.1.6 Packages	10
1.2 Putting It Together	11
1.2.1 Creating Functions	11
1.2.2 Loops	14
1.2.3 Decision Structures	21
1.2.4 Procedures	27
1.2.5 Nesting	30
1.2.6 Recursive Functions	34
1.2.7 Computation Time	36
1.3 Enough Code, Already. Show Me Some Math!	41
1.3.1 Induction	41
1.3.2 Continued Fractions	44
1.3.3 Recurrence Relations	49
1.3.4 The Sieve of Eratosthenes	52
1.4 Problems and Exercises	56
1.5 Further Explorations	63
2 Calculus	67
2.1 Revision and Introduction	67
2.1.1 Plotting	67
2.1.2 Multiple Plots	71
2.1.3 Limits	75
2.1.4 Differentiation	82
2.1.5 Integration	85
2.2 Univariate Calculus	86
2.2.1 Optimization	86

2.2.2	Integral Evaluation	89
2.2.3	Symbolic Integrals	92
2.2.4	Differential Equations	94
2.2.5	Parametric Equations, Alternative co-ordinates, and Other Esoteric Plotting Fun	97
2.3	Multivariate Calculus	104
2.3.1	Three-Dimensional Plotting	104
2.3.2	Surfaces and Volumes of Rotation	107
2.3.3	Partial and Directional Derivatives	112
2.3.4	Double Integrals	117
2.4	Exercises	124
2.5	Further Explorations	127
3	Linear Algebra	129
3.1	Introduction and Review	129
3.1.1	Vectors and Matrices in <i>Maple</i>	129
3.1.2	Simultaneous Linear Equations	134
3.1.3	Elementary Row Operations	139
3.2	Vector Spaces	148
3.2.1	Vector Spaces	148
3.2.2	Linear Combinations	151
3.2.3	Linear Independence	153
3.2.4	Basis and Dimension	158
3.3	Linear Transformations	161
3.3.1	Introduction to Linear Transformations	161
3.3.2	Linear Transformations as Matrices	162
3.3.3	Eigenvectors and Eigenvalues	166
3.3.4	Diagonalization	171
3.4	Exercises	179
3.5	Further Explorations	183
4	Visualization and Geometry: A Postscript	187
4.1	Useful Visualization Tools	187
4.1.1	Text and Labeling	187
4.1.2	Polygons, Polyhedra, and so on	192
4.2	Geometry and Geometric Constructions	196
4.2.1	Constructing a Circle Given Three Points	196
4.2.2	Constructing the Orthocenter of a Triangle	200
A	Sample Quizzes	203
A.1	Number Theory	203
A.2	Calculus	205
A.3	Linear Algebra	207
	References	209
	Index	211