

Mathematical Economics

Arsen Melkumian



London and New York

Contents

<i>Preface</i>	vii
<i>Acknowledgements</i>	ix
1 Introduction	1
1.1 <i>Basic set theory</i> 1	
1.2 <i>Functions from \mathbb{R} to \mathbb{R}</i> 8	
2 Fundamental functions and series	14
2.1 <i>Power functions</i> 14	
2.2 <i>Exponents</i> 14	
2.3 <i>Sequences and series</i> 19	
2.4 <i>Some rules of summation</i> 25	
3 Exponential and logarithmic functions	30
3.1 <i>Logarithmic function</i> 30	
3.2 <i>Exponential functions</i> 33	
3.3 <i>Mathematica examples</i> 36	
4 Limits and derivatives	39
4.1 <i>Limits</i> 39	
4.2 <i>First- and second-order derivatives</i> 42	
4.3 <i>The chain rule</i> 48	
4.4 <i>Total and marginal functions</i> 51	
4.5 <i>Growth rates</i> 54	
5 Optimization of univariate functions	57
5.1 <i>Local and global extrema</i> 57	
5.2 <i>Taylor series</i> 72	
5.3 <i>Mathematica examples</i> 78	
6 Matrix algebra	83
6.1 <i>Introduction</i> 83	
6.2 <i>Determinant of a matrix</i> 95	
6.3 <i>The matrix of cofactors</i> 100	
6.4 <i>The inverse matrix</i> 101	
6.5 <i>Systems of linear equations</i> 102	

7 Further topics in matrix algebra	108
7.1 <i>Linear dependence</i> 108	
7.2 <i>Quadratic forms</i> 109	
7.3 <i>The Hessian matrix</i> 113	
7.4 <i>Row echelon form of a matrix</i> 115	
7.5 <i>The rank of a matrix</i> 115	
7.6 <i>Eigenvalues and eigenvectors</i> 118	
7.7 <i>Kronecker product</i> 122	
7.8 <i>Vectorization of a matrix</i> 124	
7.9 <i>Mathematica examples</i> 127	
7.10 <i>Matlab examples</i> 132	
8 Optimization of bivariate and multivariate functions	133
8.1 <i>The Hessian matrix</i> 133	
8.2 <i>Two-variable functions</i> 134	
8.3 <i>Multivariate functions</i> 141	
8.4 <i>Optimization with one constraint</i> 146	
8.5 <i>Matlab example</i> 150	
9 Indefinite and definite integrals	152
9.1 <i>Indefinite integrals</i> 152	
9.2 <i>Integration by substitution and integration by parts</i> 156	
9.3 <i>Definite integrals</i> 159	
9.4 <i>Mathematica examples</i> 163	
10 Mathematics of finance	166
10.1 <i>Simple interest</i> 166	
10.2 <i>Compound interest</i> 166	
10.3 <i>Continuous compounding</i> 169	
10.4 <i>Effective annual rate</i> 169	
10.5 <i>Present value</i> 171	
10.6 <i>Car loans and mortgages</i> 175	
11 Complex numbers	179
11.1 <i>The set of complex numbers</i> 179	
11.2 <i>Polar and trigonometric form of complex numbers</i> 183	
11.3 <i>Mathematica examples</i> 186	
12 Difference and differential equations	190
12.1 <i>Difference equations</i> 190	
12.2 <i>Differential equations</i> 198	
<i>Answers to odd-numbered problems</i>	208
<i>Index</i>	219