

CONTENTS

Preface	9
Chapter I. INTRODUCTION TO ANALYSIS	
Sec. 1. Functions	11
Sec. 2. Graphs of Elementary Functions	16
Sec. 3. Limits	22
Sec. 4. Infinitely Small and Large Quantities	33
Sec. 5. Continuity of Functions	36
Chapter II. DIFFERENTIATION OF FUNCTIONS	
Sec. 1. Calculating Derivatives Directly	42
Sec. 2. Tabular Differentiation	46
Sec. 3. The Derivatives of Functions Not Represented Explicitly	56
Sec. 4. Geometrical and Mechanical Applications of the Derivative	60
Sec. 5. Derivatives of Higher Orders	66
Sec. 6. Differentials of First and Higher Orders	71
Sec. 7. Mean-Value Theorems	75
Sec. 8. Taylor's Formula	77
Sec. 9. The L'Hospital-Bernoulli Rule for Evaluating Indeterminate Forms	78
Chapter III THE EXTREMA OF A FUNCTION AND THE GEOMETRIC APPLICATIONS OF A DERIVATIVE	
Sec. 1. The Extrema of a Function of One Argument	83
Sec. 2. The Direction of Concavity. Points of Inflection	91
Sec. 3. Asymptotes	93
Sec. 4. Graphing Functions by Characteristic Points	96
Sec. 5. Differential of an Arc. Curvature	101
Chapter IV. INDEFINITE INTEGRALS	
Sec. 1. Direct Integration	107
Sec. 2. Integration by Substitution	113
Sec. 3. Integration by Parts	116
Sec. 4. Standard Integrals Containing a Quadratic Trinomial	118
Sec. 5. Integration of Rational Functions	121

Sec. 6. Integrating Certain Irrational Functions	125
Sec. 7. Integrating Trigonometric Functions	128
Sec. 8. Integration of Hyperbolic Functions	133
Sec. 9. Using Trigonometric and Hyperbolic Substitutions for Finding Integrals of the Form $\int R(x, \sqrt{ax^2 + bx + c}) dx$. Where R is a Ra- tional Function	133
Sec. 10. Integration of Various Transcendental Functions	135
Sec. 11. Using Reduction Formulas	135
Sec. 12. Miscellaneous Examples on Integration	136

Chapter V. DEFINITE INTEGRALS

Sec. 1. The Definite Integral as the Limit of a Sum	139
Sec. 2. Evaluating Definite Integrals by Means of Indefinite Integrals	140
Sec. 3. Improper Integrals	143
Sec. 4. Change of Variable in a Definite Integral	146
Sec. 5. Integration by Parts	149
Sec. 6. Mean-Value Theorem	150
Sec. 7. The Areas of Plane Figures	153
Sec. 8. The Arc Length of a Curve	158
Sec. 9. Volumes of Solids	161
Sec. 10. The Area of a Surface of Revolution	166
Sec. 11. Moments, Centres of Gravity, Guldin's Theorems	168
Sec. 12. Applying Definite Integrals to the Solution of Physical Prob- lems	173

Chapter VI. FUNCTIONS OF SEVERAL VARIABLES

Sec. 1. Basic Notions	180
Sec. 2. Continuity	184
Sec. 3. Partial Derivatives	185
Sec. 4. Total Differential of a Function	187
Sec. 5. Differentiation of Composite Functions	190
Sec. 6. Derivative in a Given Direction and the Gradient of a Function	193
Sec. 7. Higher-Order Derivatives and Differentials	197
Sec. 8. Integration of Total Differentials	202
Sec. 9. Differentiation of Implicit Functions	205
Sec. 10. Change of Variables	211
Sec. 11. The Tangent Plane and the Normal to a Surface	217
Sec. 12. Taylor's Formula for a Function of Several Variables	220
Sec. 13. The Extremum of a Function of Several Variables	222
Sec. 14. Finding the Greatest and Smallest Values of Functions	227
Sec. 15. Singular Points of Plane Curves	230
Sec. 16. Envelope	232
Sec. 17. Arc Length of a Space Curve	234

Sec. 18. The Vector Function of a Scalar Argument	235
Sec. 19. The Natural Trihedron of a Space Curve	238
Sec. 20. Curvature and Torsion of a Space Curve	242

Chapter VII. MULTIPLE AND LINE INTEGRALS

Sec. 1. The Double Integral in Rectangular Coordinates	246
Sec. 2. Change of Variables in a Double Integral	252
Sec. 3. Computing Areas	256
Sec. 4. Computing Volumes	258
Sec. 5. Computing the Areas of Surfaces	259
Sec. 6. Applications of the Double Integral in Mechanics	250
Sec. 7. Triple Integrals	262
Sec. 8. Improper Integrals Dependent on a Parameter. Improper Multiple Integrals.	269
Sec. 9. Line Integrals	273
Sec. 10. Surface Integrals	284
Sec. 11. The Ostrogradsky-Gauss Formula	286
Sec. 12. Fundamentals of Field Theory	288

Chapter VIII. SERIES

Sec. 1. Number Series	293
Sec. 2. Functional Series	304
Sec. 3. Taylor's Series	311
Sec. 4. Fourier's Series	318

Chapter IX. DIFFERENTIAL EQUATIONS

Sec. 1. Verifying Solutions. Forming Differential Equations of Families of Curves. Initial Conditions	322
Sec. 2. First-Order Differential Equations	324
Sec. 3. First-Order Differential Equations with Variables Separable. Orthogonal Trajectories	327
Sec. 4. First-Order Homogeneous Differential Equations	330
Sec. 5. First-Order Linear Differential Equations. Bernoulli's Equation	332
Sec. 6. Exact Differential Equations. Integrating Factor	335
Sec. 7. First-Order Differential Equations not Solved for the Derivative	337
Sec. 8. The Lagrange and Clairaut Equations	339
Sec. 9. Miscellaneous Exercises on First-Order Differential Equations	340
Sec. 10. Higher-Order Differential Equations	345
Sec. 11. Linear Differential Equations	349
Sec. 12. Linear Differential Equations of Second Order with Constant Coefficients	351

Sec. 13. Linear Differential Equations of Order Higher than Two with Constant Coefficients	356
Sec. 14. Euler's Equations	357
Sec. 15. Systems of Differential Equations	359
Sec. 16. Integration of Differential Equations by Means of Power Se- ries	361
Sec. 17. Problems on Fourier's Method	363

Chapter X. APPROXIMATE CALCULATIONS

Sec. 1. Operations on Approximate Numbers	367
Sec. 2. Interpolation of Functions	372
Sec. 3. Computing the Real Roots of Equations	376
Sec. 4. Numerical Integration of Functions	382
Sec. 5. Numerical Integration of Ordinary Differential Equations . .	384
Sec. 6. Approximating Fourier's Coefficients	393

ANSWERS	396
--------------------------	-----

APPENDIX	475
---------------------------	-----

I. Greek Alphabet	475
II. Some Constants	475
III. Inverse Quantities, Powers, Roots, Logarithms	476
IV. Trigonometric Functions	478
V. Exponential, Hyperbolic and Trigonometric Functions	479
VI. Some Curves	480