Contents

Preface	iii
Chapter 1. Preliminaries 1.1 Introduction 1.2 Sets and functions	1 1 1
1.3 Intervals in R1.4 Bounded sets	2 3 4
1.5 Least upper bound and greatest lower bound1.6 Bounded functions	5
Chapter 2. Limits	9
2.1 Introduction	9
2.2 Limit of a function2.3 Left and right limits	9 14
2.4 Connection between limits of sequences and limits	14
of functions	18
2.5 Basic theorems on limits	22
2.6 Infinite limit	29
2.7 Some standard limits	31
Chapter 3. Continuity	43
3.1 Introduction	43
3.2 Continuous functions	43 46
3.3 Algebra of continuous functions3.4 Types of discontinuities	53
3.5 Properties of continuous functions	58
Chapter 4. Differentiation	74
4.1 Introduction	74
4.2 Differentiability	74
4.3 Algebra of derivatives	79
4.4 Derivatives of some standard functions	81
4.5 The chain rule for differentiation4.6 Differentiation of inverse functions	87 92
4.7 Differentiation by transformation	92 98
4.8 Logarithmic differentiation	101
4.9 Differentiation of functions represented in terms of	
a parameter	104
4.10 Differentiation of a function with	
respect to another function	105

 4.11 Differentiation of implicit functions 4.12 Higher derivatives 4.13 nth derivative of some standard functions 4.14 Leibnitz's theorem 4.15 Partial derivatives 4.16 Euler's Theorem for homogeneous functions 	107 109 113 116 123 132
Chapter 5. Geometrical and Physical Applications of	
the Derivative 5.1 Introduction 5.2 Tangent and normal: Geometrical	139 139
interpretation of the derivative 5.3 Angle of intersection 5.4 Polar coordinates 5.5 Pedal equation of a curve (p-r equation) 5.6 Sub-tangent, sub-normal, length of tangent and length of normal 5.7 Physical application of derivatives	139 144 147 151 156
Chapter 6. Mean Value Theorems and Applications 6.1 Introduction 6.2 Rolle's theorem 6.3 Lagrange's first mean value theorem 6.4 Applications of mean value theorem 6.5 Cauchy's mean value theorem 6.6 Taylor's theorem and its applications 6.7 Taylor's and Maclaurin's series 6.8 Indeterminate forms	163 163 166 170 172 175 181
Chapter 7. Maxima and Minima 7.1 Introduction 7.2 Maxima and minima 7.3 Maxima and minima of functions of two variables	200 200 200 218
Chapter 8. Curvature and Evolutes 8.1 Introduction 8.2 Curvature 8.3 Evolutes	232 232 232 241
Chapter 9. Errors and Approximation 9.1 Introduction 9.2 Approximation in the case of functions of one variable 9.3 Approximations in the case of functions of several	248 248 248
variables	252

	Contents VII
Chapter 10. Envelopes 10.1 Introduction 10.2 Envelopes	260 260 260
Chapter 11. Singular Points 11.1 Introduction 11.2 Concavity and convexity 11.3 Multiple points	269 269 269 273
Chapter 12. Asymptotes 12.1 Asymptotes 12.2 Method of finding asymptotes for the curve $f(x; y) = 0$	278 278 282
Chapter 13. Curve Tracing 13.1 Introduction 13.2 Methods of tracing curves given in terms of Cartesian coordinates 13.3 Curves given in terms of polar coordinates	288 288 288 292
Answers Index	296 311