

Contents

Preface xiii

Chapter 1. Complex Numbers and the Complex Plane 2

- 1.1 Complex Numbers and Their Properties 3
- 1.2 Complex Plane 10
- 1.3 Polar Form of Complex Numbers 16
- 1.4 Powers and Roots 22
- 1.5 Sets of Points in the Complex Plane 27
- 1.6 Applications 34
- Chapter 1 Review Quiz 43

Chapter 2. Complex Functions and Mappings 46

- 2.1 Complex Functions 47
- 2.2 Complex Functions as Mappings 54
- 2.3 Linear Mappings 62
- 2.4 Special Power Functions 72
 - 2.4.1 The Power Function z^n 73
 - 2.4.2 The Power Function $z^{1/n}$ 76
- 2.5 Reciprocal Function 87
- 2.6 Applications 96
- Chapter 2 Review Quiz 100

Chapter 3. Analytic Functions 102

- 3.1 Limits and Continuity 103
 - 3.1.1 Limits 103
 - 3.1.2 Continuity 110
- 3.2 Differentiability and Analyticity 121
- 3.3 Cauchy-Riemann Equations 130
- 3.4 Harmonic Functions 137
- 3.5 Applications 141
- Chapter 3 Review Quiz 148

Chapter 4. Elementary Functions 150

- 4.1 Exponential and Logarithmic Functions 151
 - 4.1.1 Complex Exponential Function 151
 - 4.1.2 Complex Logarithmic Function 156
- 4.2 Complex Powers 166

4.3	Trigonometric and Hyperbolic Functions	171
4.3.1	Complex Trigonometric Functions	171
4.3.2	Complex Hyperbolic Functions	179
4.4	Inverse Trigonometric and Hyperbolic Functions	183
4.5	Applications	190
	Chapter 4 Review Quiz	198

Chapter 5. Integration in the Complex Plane 200

5.1	Real Integrals	201
5.2	Complex Integrals	209
5.3	Cauchy-Goursat Theorem	218
5.4	Independence of Path	226
5.5	Cauchy's Integral Formulas and Their Consequences	233
5.5.1	Cauchy's Two Integral Formulas	233
5.5.2	Some Consequences of the Integral Formulas	237
5.6	Applications	243
	Chapter 5 Review Quiz	254

Chapter 6. Series and Residues 258

6.1	Sequences and Series	259
6.2	Taylor Series	269
6.3	Laurent Series	278
6.4	Zeros and Poles	288
6.5	Residues and Residue Theorem	294
6.6	Some Consequences of the Residue Theorem	302
6.6.1	Evaluation of Real Trigonometric Integrals	303
6.6.2	Evaluation of Real Improper Integrals	304
6.6.3	Integration along a Branch Cut	310
6.6.4	The Argument Principle and Rouché's Theorem	311
6.6.5	Summing Infinite Series	315
6.7	Applications	321
	Chapter 6 Review Quiz	331

Chapter 7. Conformal Mappings 334

7.1	Conformal Mapping	335
7.2	Linear Fractional Transformations	343
7.3	Schwarz-Christoffel Transformations	351
7.4	Poisson Integral Formulas	359
7.5	Applications	367
7.5.1	Boundary-Value Problems	367
7.5.2	Fluid Flow	374
	Chapter 7 Review Quiz	383

Appendices:	I	Proof of Theorem 3.1.1 APP-1
	II	Proof of the Cauchy-Goursat Theorem APP-3
	III	Table of Conformal Mappings APP-7

Answers to Selected Odd-Numbered Problems ANS-1

Symbol Index IND-1

Word Index IND-5