

# **Introduction to Complex Analysis**

Revised Edition

---

H. A. PRIESTLEY

CLARENDON PRESS · OXFORD

# Contents

---

<b>Notation and terminology</b>	<b>xiii</b>
<b>1. The complex plane</b>	<b>1</b>
Complex numbers	1
Open and closed sets in the complex plane	6
Limits and continuity	9
Exercises	11
<b>2. Holomorphic functions and power series</b>	<b>13</b>
Holomorphic functions	13
Complex power series	18
Elementary functions	21
Exercises	26
<b>3. Prelude to Cauchy's theorem</b>	<b>28</b>
Paths	28
Integration along paths	31
Connectedness and simple connectedness	39
Properties of paths and contours	43
Exercises	47
<b>4. Cauchy's theorem</b>	<b>49</b>
Cauchy's theorem, Level I	50
Cauchy's theorem, Level II	56
Logarithms, argument, and index	57
Cauchy's theorem revisited	61
Exercises	62
<b>5. Consequences of Cauchy's theorem</b>	<b>64</b>
Cauchy's formulae	65
Power series representation	69
Zeros of holomorphic functions	72
The Maximum-modulus theorem	75
Exercises	76

<b>6. Singularities and multivalued functions</b>	<b>79</b>
Laurent's theorem	79
Singularities	84
Meromorphic functions	88
Multivalued functions	91
Exercises	101
<b>7. Cauchy's residue theorem</b>	<b>104</b>
Cauchy's residue theorem	104
Counting zeros and poles	107
Calculation of residues	109
Estimation of integrals	112
Exercises	116
<b>8. Applications of contour integration</b>	<b>118</b>
Improper and principal-value integrals	118
Integrals involving functions with a finite number of poles	120
Integrals involving functions with infinitely many poles	125
Deductions from known integrals	126
Integrals involving multivalued functions	128
Evaluation of definite integrals: summary	130
Summation of series	131
Exercises	133
<b>9. Fourier and Laplace transforms</b>	<b>135</b>
The Laplace transform: basic properties and evaluation	136
The inversion of Laplace transforms	138
The Fourier transform	145
Applications to differential equations, etc.	150
Appendix: proofs of the Inversion and Convolution theorems	157
Convolutions	159
Exercises	161
<b>10. Conformal mapping and harmonic functions</b>	<b>164</b>
Circles and lines revisited	165
Conformal mapping	168
Möbius transformations	170
Other mappings: powers, exponentials, and the Joukowski transformation	174

Examples on building conformal mappings	176
Holomorphic mappings: some theory	181
Harmonic functions	183
Exercises	191
<b>Supplementary exercises</b>	<b>193</b>
<b>Bibliography</b>	<b>207</b>
<b>Notation index</b>	<b>209</b>
<b>Subject index</b>	<b>211</b>