

Contents

1	Introduction	7
2	The Real and Complex Numbers	9
2.1	Real and Rational Numbers	9
2.2	Exercises	12
2.3	Set Notation	12
2.4	Order	13
2.5	Exercises	17
2.6	The Binomial Theorem	18
2.7	Well Ordering and Archimedean Property	19
2.8	Arithmetic of Integers	21
2.9	Exercises	23
2.10	Completeness of \mathbb{R}	25
2.11	Existence of Roots	27
2.12	Exercises	28
2.13	The Complex Numbers	30
2.14	Dividing Polynomials	32
2.15	The Cauchy Schwarz Inequality	34
2.16	Integer Multiples of Irrational Numbers	35
2.17	Exercises	36
3	Set Theory	39
3.1	Basic Definitions	39
3.2	The Schroder Bernstein Theorem	41
3.3	Equivalence Relations	45
3.4	Hausdorff Maximal Theorem*	45
3.5	Exercises	47
4	Functions and Sequences	49
4.1	General Considerations	49
4.2	Sequences	51
4.3	Exercises	52
4.4	The Limit of a Sequence	54
4.5	Cauchy Sequences	57
4.6	The Nested Interval Lemma	58
4.7	Exercises	59
4.8	Compactness	60
4.8.1	Sequential Compactness	60
4.8.2	Closed and Open Sets	61
4.8.3	Compactness and Open Coverings	64
4.8.4	Complete Separability	65
4.9	Exercises	66
4.10	Cauchy Sequences and Completeness	68