The Book of Math (Notes)

Kevin Kuo

November 11, 2020

Forward and Disclaimer

These are math notes made by a student (with a physics major and math minor) based off text books. It may contain misconceptions and misinterpretations, thus should not be viewed in the same light of a text book. Use at your own risk and mental sanity.

Symbols

Logic

Name	Symbol	Comment
Exists	$\exists$	There exists at least one
For all	$\forall$	
Not exists	$\nexists$	There does not exist
Exists one	$\exists!$	There only exists one and only one
And	$\wedge$	
Or	$\vee$	Inclusive or
Not	$\neg$	
Logically implies	$\Longrightarrow$	If
Logically implied by	$\Longleftarrow$	Only if
Logically equivalent	$\Longleftrightarrow$	If and only if
Implies	$\longrightarrow$	
Implied by	$\longleftarrow$	
Double Implication	$\longleftrightarrow$	

Set Notation

Name	Symbol	Comment
Empty Set	$\varnothing$	The set that is empty
Natural Numbers	$\mathbb{N}$	Set of natural numbers not containing 0, equivalent to the set of positive integers
Integers	$\mathbb{Z}$	Set of integers
Rational Numbers	$\mathbb{Q}$	
Real Numbers	$\mathbb{R}$	
Complex Numbers	$\mathbb{C}$	
In	$\in$	
Not in	$\notin$	
Owns	$\ni$	Has an element
Proper Subset	$\subset$	Subset that is not itself
Subset	$\subseteq$	
Superset	$\supset$	Superset that is not itself
Proper Superset	$\supseteq$	
Power set	$\wp$	

Union	$\cup$	
Intersection	$\cap$	
Difference	$\setminus$	

Relationships

Name	Symbol	Comment
Defined	$\doteq$	
Approximate	$\approx$	
Equivalent	$\equiv$	Isomorphic (Group Theory)
Congruent	$\cong$	Homomorphic (Group Theory)
Proportional	$\propto$	

Operators

Name	Symbol	Comment
	$\oplus$	
	$\otimes$	
	$\odot$	
	$\circ$	Convolution
Dagger	$\dagger$	Complex conjugate transpose of a matrix

Arrows

Name	Symbol	Comment
Maps to	$\mapsto$	

Hebrew

Name	Symbol	Comment
Aleph	$\aleph$	Carnality of infinite sets that can be well ordered

Other

Name	Symbol	Comment
Real part	$\Re$	Real part of a number
Imaginary part	$\Im$	Imaginary part of a number

Contents

Part I

Logic

Part II

Numbers

Chapter 1

Natural Numbers $\mathbb{N}$

Chapter 2

Integers $\mathbb{Z}$

Chapter 3

Rationals $\mathbb{Q}$

Chapter 4

Reals $\mathbb{R}$

Chapter 5

Complex $\mathbb{C}$

Part III

Real Analysis

Books Used:

1. Kenneth A. Ross - Elementary Analysis (2nd Ed.) [1]

Part IV

Complex Analysis

Books Used:

1. Brown and Churchill - Complex Variables and Applications [2]

Chapter 6

Conformal Mapping

Part V

Differential Equations

Part VI

Partial Differential Equations

Part VII

Linear Algebra

Chapter 7

Markov Chains

Part VIII

Tensors

Part IX

Riemann Geometry

Part X

Group Theory

Part XI

Galois Theory

Part XII

Set Theory

Part XIII

Model Theory

Part XIV

Tips and Tricks

Chapter 8

Integration Techniques

8.1 DI Method (Integration Table)

8.2 Feynman Integration

Part XV

Bibliography

Bibliography

[1] Kenneth A. Ross. *Elementary Analysis*. Springer, 2 edition, 2013.

[2] James Ward Brown and Ruel V. Churchill. *Complex Variables and Applications*. McGraw-Hill Education, 9 edition, 2014.