Mathematics

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Friday, October 4, 2024

Contents

1 Rings and Fields **2**

2 Linear Algebra **3**

3 Topology **4**

4 Real Analysis **5**

Chapter 1

Rings and Fields

Definition 1.0.1: Rings

A ring $(R, +, \cdot)$ is set R equipped with two binary operations, addition $+ : R \times R \to R$ and multiplication $\cdot : R \times R \to R$ satisfying the following conditions.

(i) **Associative addition:** $(x + y) + z = x + (y + z)$, for all $x, y, z \in R$.

(ii) **Commutative addition:** $x + y = y + x$, for all $x, y \in R$.

(iii) **Additive identity:** There exists an element, denoted $0 \in R$ such that $x + 0 = x$, for all $x \in R$.

(iv) **Additive inverse:** For all $x \in R$, there exists an element $-x \in R$ such that $x + (-x) = 0$.

(v) **Associative multiplication:** $(x \cdot y) \cdot z = x \cdot (y \cdot z)$, for all $x, y, z \in R$.

(vi) **Multiplicative identity:** There exists an element, denoted $1 \in R$ such that $x \cdot 1 = 1 \cdot x = x$, for all $x \in R$.

(vii) **Left distributivity:** $x \cdot (y + z) = (x \cdot y) + (x \cdot z)$, for all $x, y, z \in R$.

(viii) **Right distributivity:** $(y + z) \cdot x = (y \cdot x) + (z \cdot x)$, for all $x, y, z \in R$.

Chapter 2

Linear Algebra

Chapter 3

Topology

Chapter 4

Real Analysis

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