MA491: Introduction to Real Analysis

Baker University — Spring 2024

Each of the following items refers to the indicated section from the course textbook *Introduction to Real Analysis* (Fourth Edition) by Robert G. Bartle and Donald R. Sherbert.

Exam 1: Essential Properties of Real Numbers

date	day	section	topic(s)
1/29	M	Chapter 1: Preliminaries	∘ sets and functions ∘ mathematical induction ∘ finite and infinite sets
1/31	W	§2.1: The Algebraic and Order Properties of $\mathbb{R}$	∘ field operations ∘ (ir)rational numbers ∘ inequalities
2/2	F	§2.2 Absolute Value and the Real Line	∘ absolute value ∘ Triangle Inequality ∘ neighborhoods

date	day	section	topic(s)
2/5	M	§2.3: The Completeness Property of $\mathbb{R}$	∘ upper and lower bounds ∘ suprema and infima
2/7	W	§2.4: Applications of the Supremum Property	∘ bounded functions ∘ Archimedean Property ∘ density of $\mathbb{Q}$ in $\mathbb{R}$
2/9	F	§2.5: Intervals	∘ open- and closedness ∘ nested intervals ∘ uncountability of $\mathbb{R}$

date	day	section	topic(s)
2/12	M	Exam 1 Review	
2/14	W	Exam 1 Review	Exam 1 Practice Test
2/16	F	**Exam 1**	∘ §1.1: Sets and Functions ∘ §1.2: Mathematical Induction ∘ §1.3: Finite and Infinite Sets ∘ §2.1: The Algebraic and Order Properties of $\mathbb{R}$ ∘ §2.2: Absolute Value and the Real Line ∘ §2.3: The Completeness Property of $\mathbb{R}$ ∘ §2.4: Applications of the Supremum Property ∘ §2.5: Intervals

Exam 2: Sequences of Real Numbers

date	day	section	topic(s)
2/19	M	§3.1: Sequences and Their Limits	∘ convergence of sequences ∘ uniqueness of limits
2/21	W	§3.2: Limit Theorems	∘ boundedness ∘ Squeeze Theorem ∘ algebraic operations
2/23	F	§3.3: Monotone Sequences	∘ monotonicity ∘ Monotone Convergence Theorem ∘ applications and examples

date	day	section	topic(s)
2/26	M	§3.4: The Bolzano-Weierstrass Theorem	∘ subsequences ∘ Divergence Criterion ∘ Monotone Subsequence Th'm ∘ Bolzano-Weierstrass Th'm
2/28	W	§3.5: The Cauchy Criterion	∘ Cauchy sequences ∘ Cauchy Convergence Criterion
3/1	F	§3.6: Properly Divergent Sequences	∘ infinite limits ∘ Monotone Convergence Th'm

date	day	section	topic(s)
3/4	M	Exam 2 Review	
3/6	W	Exam 2 Review	Exam 2 Practice Test
3/8	F	**Exam 2**	∘ §3.1: Sequences and Their Limits ∘ §3.2: Limit Theorems ∘ §3.3: Monotone Sequences ∘ §3.4: Subsequences and the Bolzano-Weierstrass Th'm ∘ §3.5: The Cauchy Criterion ∘ §3.6: Properly Divergent Sequences

Exam 3: Limits and Continuity

date	day	section	topic(s)
3/11	M	§4.1: Limits of Functions	∘ cluster points ∘ uniqueness of limits ∘ Sequential Criterion ∘ Divergence Criteria
3/13	W	§4.2: Limit Theorems	∘ algebraic operations ∘ Squeeze Theorem
3/15	F	§4.3: Some Extensions of the Limit Concept	∘ one-sided limits ∘ infinite limits ∘ limits at infinity ∘ Comparison Theorems

date	day	section	topic(s)
3/25	M	§5.1: Continuous Functions	◦ Sequential Criterion ◦ Discontinuity Criterion ◦ Dirichlet's function
3/27	W	§5.2: Combinations of Continuous Functions	◦ algebraic operations ◦ polynomial functions ◦ rational functions

date	day	section	topic(s)
4/1	M	§5.3: Continuous Functions on Intervals	◦ Boundedness Theorem ◦ Maximum-Minimum Theorem ◦ Intermediate Value Theorem ◦ Preservation of Intervals Th'm
4/3	W	§5.4: Uniform Continuity	◦ nonuniform continuity ◦ Uniform Continuity Th'm ◦ Lipschitz functions ◦ Continuous Extension Th'm
4/5	F	§5.6: Monotone and Inverse Functions	◦ monotonicity ◦ jump at a point ◦ Continuous Inverse Theorem

date	day	section	topic(s)
4/8	M	Exam 3 Review	
4/10	W	Exam 3 Review	Exam 3 Practice Test
4/12	F	**Exam 3**	◦ §4.1: Limits of Functions ◦ §4.2: Limit Theorems ◦ §4.3: Some Extensions of the Limit Concept ◦ §5.1: Continuous Functions ◦ §5.2: Combinations of Continuous Functions ◦ §5.3: Continuous Functions on Intervals ◦ §5.4: Uniform Continuity ◦ §5.6: Monotone and Inverse Functions

Exam 4: Differentiability and Integrability

date	day	section	topic(s)
4/15	M	§6.1: The Derivative	◦ differentiability ◦ differentiability implies continuity ◦ algebraic operations ◦ Carathéodory's Theorem ◦ Chain Rule
4/17	W	*Scholars Symposium*	
4/19	F	§6.2: The Mean Value Theorem	◦ Interior Extremum Theorem ◦ Rolle's Theorem ◦ First Derivative Test ◦ Darboux's Theorem

date	day	section	topic(s)
4/22	M	§6.3: L'Hôpital's Rule	◦ indeterminate form ◦ Cauchy Mean Value Theorem
4/24	W	§7.1: Riemann Integral	◦ (tagged) partitions ◦ norm of a partition ◦ Riemann sum ◦ Riemann integrability ◦ uniqueness of Riemann integrals ◦ Boundedness Theorem
4/26	F	§7.2: Riemann Integrable Functions	◦ Cauchy Criterion ◦ Squeeze Theorem ◦ continuity ◦ monotonicity ◦ additivity of Riemann integrals

date	day	section	topic(s)
4/29	M	§7.3: The Fundamental Theorem	◦ Substitution Theorem ◦ Composition Theorem ◦ Product Theorem ◦ integration by parts
5/1	W	Exam 4 Review	
5/3	F	**Exam 4**	◦ §6.1: The Derivative ◦ §6.2: The Mean Value Theorem ◦ §6.3: L'Hôpital's Rule ◦ §7.1: Riemann Integral ◦ §7.2: Riemann Integrable Functions ◦ §7.3: The Fundamental Theorem

date	day	section	topic(s)
5/6	M	Final Exam Review	
5/8	W	Final Exam Review	
5/10	F	Final Exam Review	Final Exam Practice Test

Our **final exam** will be held Friday, May 17 from 1:00 PM to 4:00 PM in Mulvane 201.