# Advanced Calculus 1 — Handout MAT 525/625 Fall 2014 — D. Ivanšić

### Test Knowledge

#### Sections 1.1, 1.2, 1.3, 2.1–2.4

**Definitions** Injective, surjective, bijective function (1.1.9)

Finite and infinite sets (1.3.1)

Denumerable and countable sets (1.3.6)

 $\epsilon$ -neighborhood of a (2.2.7)

Set bounded above/below, bounded, unbounded (2.3.1)

Supremum and infimum of a set (2.3.2)

**Theorems** Well-ordering property of N (1.2.1)

and Principle of mathematical induction (1.2.2)

**Axioms** Theorems 1.3.5, 1.3.9, 1.3.10

Theorems 1.3.8, 1.3.11, 1.3.12 Cantor's Theorem (1.3.13)Algebraic properties of  $\mathbf{R}$  (2.1.1)

Order properties of  $\mathbf{R}$  (2.1.5) Theorem 2.1.7

Theorem 2.1.9

Triangle inequality & Corollary (2.2.3, 2.2.4)

Completeness Property of  $\mathbf{R}$  (2.3.6)

Lemmas 2.3.3 and 2.3.4 Archimedean Property (2.4.3)

Density of  $\mathbf{Q}$  and irrationals (2.4.8, 2.4.9)

**Proofs** Nonexistence of rational number r so that  $r^2 = 2$  (2.1.4)

Theorem 2.1.9

Existence of  $\sqrt{2}$  (2.4.7)

Archimedean Property (2.4.3)

Density of  $\mathbf{Q}$  (2.4.8)

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#### **Sections 3.1–3.6**

**Definitions** Sequence (3.1.1)

Limit of a sequence (3.1.3) m-tail of a sequence (3.1.8) Bounded sequence (3.2.1) Monotone sequence (3.3.1) Euler's number e (3.3.6)

Subsequence of a sequence (3.4.1)

Cauchy sequence (3.5.1) Contractive sequence (3.5.7)

Sequences tending to  $\infty$  or  $-\infty$  (3.6.1)

**Theorems** Theorem 3.1.10

Theorem 3.2.2

Limit Theorems (3.2.3)

Theorem 3.2.5

Squeeze Theorem (3.2.7)

Theorem 3.2.11

Monotone Convergence Theorem (3.3.2)

Theorem 3.4.2

Monotone Subsequence Theorem (3.4.7) Bolzano-Weierstrass Theorem (3.4.8) Cauchy Convergence Criterion (3.5.5)

Theorem 3.5.8, Corollary 3.5.10

Theorems 3.6.4, 3.6.5

Extended Limit Theorems (involving  $\infty$ )

**Proofs** Theorem 3.2.2

Limit Theorems (3.2.3)

Monotone Convergence Theorem (3.3.2)

Example 3.3.5

Bolzano-Weierstrass Theorem (3.4.8) Cauchy Convergence Criterion (3.5.5)

Theorem 3.5.8, Corollary 3.5.10

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#### **Sections 4.1–4.3**

**Definitions** Cluster point (4.1.1)

Limit of a function (4.1.4)

Boundedness on a neighborhood (4.2.1)

One-sided limits (4.3.1) Infinite limit (4.3.5) Limit at infinity (4.3.10)

Infinite limit at infinity (4.3.13)

**Theorems** Theorem 4.1.2

Theorem 4.1.6

Sequential criteria for limits (4.1.8, 4.1.9)

Limit Theorems (4.2.4)Squeeze Theorem (4.2.7)

Theorem 4.3.3

Comparison Theorem 4.3.7

Sequential criteron for limits (4.3.11, 4.3.14)Extended Limit Theorems (involving  $\infty$ )

Limit test Theorem 4.3.15

**Proofs** Theorem 4.1.2

Sequential criterion (4.1.8)

Limit Theorems by definition (4.2.4)

Limit test Theorem 4.3.15