REVIEW FOR MAT 322 MIDTERM I
CHAPTERS 1–3 IN THE TEXTBOOK

• §3 — Topology in $\mathbb{R}^n$, including the following. Metric spaces, open and closed subsets, Euclidean and sup metrics on $\mathbb{R}^n$, general notion of limits and continuity. The closure $\overline{A}$, interior $\text{Int} A$, exterior $\text{Ext} A$ and the boundary $\text{Bd} A$ of a subset $A \subseteq \mathbb{R}^n$ and their properties like $\text{Bd} A = \overline{A} \setminus \text{Int} A$, $\text{Bd} S \subseteq \text{Bd} S$ etc. Know which statements about these notions are false and cannot be used, and understand exercises on pp. 30–31.

• §4 — The basics of compact and connected subsets of $\mathbb{R}^n$. These include definition of compact and connected subsets and their basic properties like "$X \subset \mathbb{R}^n$ is compact if and only if $X$ is bounded and closed", the extreme-value theorem, the uniform continuity, the intermediate-value theorem, etc. Understanding the proofs of all theorems in this section and exercises 1, 2 and 4 on pp. 39–40.

• §§5–7 — The derivative, continuously differentiable functions, condition for the equality of mixed partial derivatives, the chain rule. Understanding of all theorems, examples and exercises.

• §8 — The inverse function theorem. Understanding precise statement of the theorem, its proof, examples and exercises on pp. 70–71.

• §9 — The implicit function theorem. Understanding precise statement of the theorem, its proof, examples and exercises on pp. 78–79.

• §10 — Definition of the Riemann integral, the Riemann condition (Theorem 10.3), understanding exercises on pp. 90–91. All results and properties of a one variable Riemann integral from MAT 320.

• §11 — Properties and examples of measure zero sets, necessary and sufficient condition for integrability (Theorem 11.2), understanding precise statement of Theorem 11.3, examples and exercises on pp. 97–98.

• §12 — Understanding precise statement of Fubini’s theorem and its corollaries, and exercises on p. 103.

• §13 — Definition of the Riemann integral over a bounded set and its properties, sufficient condition for integrability over the bounded set (Theorem 13.5), relation between integrals over $S$ and $A = \text{Int} S$ (Theorem 13.6), examples 1–5 on p. 111.

• §14 — Definition and properties of rectifiable sets, examples of bounded open sets whose boundary does not have measure zero, examples and exercises on pp. 120–121.

• §15 Definition and properties of improper integrals, existence and relation with Riemann integrals (Theorem 15.4) and its corollary; skip Theorem 15.6. Understanding of examples and basic exercises on pp. 132–133.

• Special attention to all homework problems, you suppose to know and understand their solutions.