Operations and quantifiers

- Operations: conjunction, disjunction, biconditional, conditional.
- Propositional equivalence.
- Quantifiers: truth values, negations, and translations.

Methods of Proof

- Direct and indirect proofs of implication.
- Proof by contradiction. Irrationality of $\sqrt{2}, \sqrt{3}$.
- Proof of a biconditional.
- Proof by cases.
- Mathematical induction.

Sets

- Notation and the power set.
- Operations on sets.
- Generalized unions and intersections.

Inequalities

- Solving inequalities.

Functions

- Definition of a function.
- Injective, surjective, bijective functions.
- Composition of functions and the inverse of a function.

Denumerable and uncountable sets

- Proving that a set is denumerable using definition.
- Facts about denumerable sets. Showing that if $A, B$ are denumerable then $A \cup B$ is denumerable.
• Uncountable sets: set of infinite binary sequences, set of functions from $N$ to $\{1, 2, 3\}$, set of real numbers.
• Cantor’s theorem with a proof.

7. Relations
• Properties of a relation: reflexive, symmetric, transitive, antisymmetric.
• Equivalence relations and equivalence classes.
• Equivalence class on $A$ gives a partition of $A$. Theorem 5.5.1 with a proof.

8. Limits
• Proving that $\lim_{n\to\infty} a_n = a$ using definition.