1. Integers
   1. divisibility
   2. prime, composite, relatively prime
   3. modular arithmetic

2. Statements
   1. if-then, if and only if
   2. and, or, not connectives
   3. quantifiers
      1. exists (there is)
      2. for all (every)
      3. compound statements
      4. negations

3. Proofs and Counterexamples
   1. direct proofs
      1. if-then statements
      2. if and only if statements
   2. indirect proofs
      1. contrapositive
      2. proof by contrapositive
      3. proof by contradiction
   3. mathematical induction
      1. standard form
      2. strong form
      3. formulas (equalities) vs. inequalities
      4. recursive definitions

4. Boolean Algebra
   1. operations
   2. truth tables
   3. logical equivalence
   4. properties
   5. tautology

5. Lists
   1. multiplication principle
   2. counting: with and without repetition
   3. factorials
6. Sets
   1. Venn diagrams
   2. inclusion-exclusion principle
      1. \(|A \cup B| = |A| + |B| - |A \cap B|\)
      2. extension to more than two sets
      3. applications
      4. derangements
   3. subsets
   4. binomial coefficients
      1. properties
      2. binomial theorem
      3. Pascal’s triangle, Pascal’s identity
      4. formula
      5. applications: lottery, card hands, probability
   5. power set
   6. set operations
      1. union, intersection
      2. difference, symmetric difference
      3. Cartesian product
   7. properties
      1. associative, commutative, distributive
      2. others
   8. proofs of \(A \subseteq B\) and \(A = B\)
      1. showing set containment
      2. using logical operations
      3. using Venn diagrams

7. Relations
   1. subsets of the Cartesian product
   2. reflexive, irreflexive, symmetric, antisymmetric, transitive
   3. inverse relation
   4. equivalence relations
      1. examples: modular arithmetic, subsets
      2. reflexive, symmetric, transitive
      3. partitions
      4. equivalence classes
      5. counting equivalence classes
         1. subsets of a fixed size
         2. anagrams

8. Functions
   1. domain, image
   2. inverse function
   3. one-to-one, onto, bijection
   4. counting functions
   5. composition