Math 220, 1st Midterm Exam Review

The best ways to prepare for the exam are to review your class notes, re-read the text material, review the homework problems, and work on other problems in the text. Below is a review of some of the key concepts and results to remember.

Chapter 1. Know the quantifiers $(\forall, \exists)$, negations, converse, inverse of a statement, contrapositive, proof by contradiction, counterexample.

Chapter 2.

- Know the basic set operations (union, intersection, complement), subsets
- know how to prove two sets are equal (to show $A = B$, ones needs to show two inclusions: $A \subseteq B$ and $B \subseteq A$).
- Relations, equivalent relations, equivalent classes, Cartesian product.
- Functions:
  - The definition of a function being injective, surjective, bijective. The domain of f, the range of f and composition of functions.
  - For a function $f : A \to B$, know the meaning of the image set $f(C)$ for $C \subseteq A$ and the pre-image set $f^{-1}(D)$ for $D \subseteq B$.
  - Understand when the inverse function can be defined.
- Definition of a set is finite, infinite, denumberable, countable, uncountable. Important results:
  - Any subset of a countable set is countable.
  - A countable union of countable sets is countable.
  - For a non-empty set S, the following conditions are equivalent:
    (1) S is countable
    (2) There is an injection $f : S \to \mathbb{N}$
    (3) There is a surjection $g : \mathbb{N} \to S$.
  - $\mathbb{Q}$ is denumerable and $\mathbb{R}$ is uncountable.