**1.** Abbott 1.2.5

**2.** Abbott 1.2.9

**3.** Let $A$ and $B$ be sets such that $A$ is countably infinite. Carefully show that if $B$ is finite, then $A \cup B$ is countably infinite, and if $B$ is countably infinite, then $A \cup B$ is countably infinite.

**4.** Prove that the following sets have the same cardinality.

a) $(0,1)$

b) $[0,1)$

c) $[0,1]$

d) $(0,1) \cup \mathbb{Z}$

e) $\mathbb{R}$

**5.** **(Hand this one in to David.)**

a) Use induction to prove that a finite product of countably infinite sets is countably infinite.

b) Show that a countable product of countably infinite sets need not be countable.

**6.** Abbott 2.2.1

**7.** Abbott 2.2.7

**8.** Carefully prove that the sequence $(x_n)$ given by $x_n = (-1)^n$ does not converge.

**9.** Abbott 2.3.2

**10.** Abbott 2.3.3 **(Hand this one in to David.)**