

# Practice Final, Mathematics 101

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December 11, 2000

## **Problem 1.**

Construct a bijection between a square and a closed interval.

**Problem 2.**

Show that the set of all finite subsets of a countable set is again countable.

**Problem 3.**

Show that for any three nonempty sets  $X, Y, Z$

$$|X^Z \times Y^Z| = |(X \times Y)^Z|.$$

**Problem 4.**

Draw the Cayley graph of  $S_4$  with generators  $a = (12)$  and  $b = (1234)$ .

**Problem 5.**

Give an example of a non abelian group of order 12. How many abelian groups of order 12 are there?

**Problem 6.**

Show that a group with only two subgroups is cyclic.

**Problem 7.**

Show that there are no continuous injective maps of the unit circle to the real line.