1. Let G be the group with presentation $G = \langle a, b, c \,|\, a^3 = b, ac = ca \rangle$.

   (a) Simplify the word $a^4c^2a^2b^{-3}cb$.

   (b) Show that $a^{-1}c^{-1} = c^{-1}a^{-1}$

   (c) Simplify the word $a^{-9}c^{-1}b^2c^2a$.

   (d) Prove that the group is abelian. [Hint: It suffices to argue that $ab = ba$ and $bc = cb$.]

2. Let X be the set $X = \{1, 2, 3\}$.

   (a) Give an example of two different functions from X to X.

   (b) How many functions are there from X to X?

   (c) How many one-to-one correspondences are there from X to X?

3. As before, let $X = \{1, 2, 3\}$. Let $f, g : X \to X$ where $f(1) = 2, f(2) = 3, f(3) = 1$ and $g(1) = 3$, $g(2) = 2$ and $g(3) = 1$.

   (a) Find $(f \circ g)(i)$ for $i = 1, 2, 3$

   (b) Find $(g \circ f)(i)$ for $i = 1, 2, 3$

   (c) What is f^{-1}? Describe as above.

   (d) What is g^{-1}? Describe as above.

   (e) What is $f \circ f \circ f$?