1. A permutation $p$ is called a nontrivial involution if $p^2 = 12\ldots n$, but $p \neq 12\ldots n$. Prove that if $n > 1$, the number of nontrivial involutions in $S_n$ is odd.
2. Find an explicit formula for $c(n, n - 3)$. 
3. Let $p$ be a permutation of the cyclic type $(c_1, \ldots, c_n)$. Show that $p^\ell = 123\ldots n$, where

$$\ell = \prod_{i : c_i \neq 0} i.$$