1. **Permutation notations**. Write the permutation
   - 87253641 in cycle notation.
   - (321)(64)(75)(8) in non-cycle notation.
2. **Permutations do not commute**. Show that
$$(123)(345) \neq (345)(123).$$
3. **Orders of permutations**. The *order* of a permutation $\sigma \in S_n$ is the smallest positive integer d such that σ^d is the identity.
   - Use the pigeonhole principle to show that the order of σ is well-defined, and in fact is at most $n!$. (In fact, Lagrange's theorem implies that the order of σ divides $n!$, but we don't need that here).
   - Convince yourself that the order of a k-cycle is exactly k. Given an arbitrary permutation in cycle notation, how can you find its order?
   - What is the largest possible order for a permutation in S_{10}, and how many permutations have this order?
   - List all the possible cycle structures for permutations in S_{10} that have order 6, 18, and 21. Pick a couple of these cycle structures and compute how many elements they have.
   - What is the smallest value of n such that S_n contains a permutation of order 100?