1. Prove that \( \mathbb{Q} \) under addition is not a cyclic group.

2. Let \( G \) be an abelian group. Prove that the elements of finite order of \( G \) form a subgroup. (This subgroup is called the torsion subgroup of \( G \).)

3. Let \( G \) be a group with \( a, b \in G \).
   
   a) Let \( m \in \mathbb{Z}^+ \). Prove that if \((ab)^m = e\) then \((ba)^m = e\).
   
   b) Use part (a) to show that \( ab \) and \( ba \) have the same order. (Don’t forget to consider the case that the order is infinite!)