**1.** Let $G$ be a group of order 12. In this exercise, we will show that if the Sylow 3 subgroup of $G$ is not normal, then $G \cong A_4$.

   i. Determine the number of possibilities of $n_3$.

   ii. Let $\varphi$ denote the permutation representation associated with the action of $G$ on the set of Sylow 3 subgroups. Show that $\ker(\varphi) = \{e\}$.

   iii. Determine the number of order 3 elements in $G$.

   iv. Complete the proof by counting the number of subgroups of order 12 of $\mathfrak{S}_4$.