1. Section 2.3, Problem 1.

2. Section 2.3, Problem 7.

3. Find a $\sigma \in S_9$ with $\sigma^{20} = e$ and $\sigma^i \neq e$ for $1 \leq i < 20$.
   (Hint: Recall $\sigma = \begin{pmatrix} 12345 \\ 23154 \end{pmatrix}$ has $\sigma^6 = e$ and do something similar.)
   (Recall notation: $S_n$ is the set of all permutations on $\{1, \ldots, n\}$.)

4. In $\mathbb{Z}_{13}^*$ let $H = \{1, 5, 12, 8\}$. List the right cosets $Ha$. (Recall notation: when $p$ is a prime $\mathbb{Z}_p^*$ has elements $\{1, \ldots, p-1\}$ and the operation is multiplication modulo $p$.)

5. In $S_3$ let $H = \{e, \sigma\}$ with $\sigma = \begin{pmatrix} 123 \\ 213 \end{pmatrix}$ List the right cosets of $H$. List the left cosets of $H$.

Deep in the human consciousness is a pervasive need for a logical universe that makes sense. But the real universe is always one step beyond logic.
– from *Dune* by Frank Herbert