1. Prove or disprove: the language $X(L) = \{w \in L \mid wy \notin L \text{ for any } y \neq \epsilon \}$ is regular for every regular language $L$.

2. Write regular expressions for the following languages:
   (a) $\{w \in \{0, 1, 2\}^* \mid w \text{ contains the substring 01 } \}$.
   (b) $\{w \in \{0, 1, 2\}^* \mid w \text{ does not have the substring 01 and w has the substring 10} \}$.

3. Use the pumping lemma to prove in detail that the language $\{a^n b^m \mid 2n < m \}$ is not regular.