1. (15 Points) Consider the problem of determining whether a DFA and a regular expression are equivalent. Express this problem as a language and show that it is decidable.

2. (15 Points) If $A \leq_m B$ and $B$ is a regular language, does that imply that $A$ is a regular language? Why or why not?

3. (15 Points) Show that the Post Correspondence Problem is decidable over the unary alphabet $\Sigma = \{1\}$.

4. (15 Points) Show that the Post Correspondence Problem is undecidable over the binary alphabet $\Sigma = \{0, 1\}$.

5. (5 Points each) Show that the following is either TRUE or FALSE:

   a. $3^n = 2^{O(n)}$

   b. $2n = o(n^2)$

   c. $n = o(\log n)$

   d. $1 = o(1/n)$

   e. $2^n = O(2^n)$

6. (15 Points) Let DOUBLE-SAT = \{\langle \phi \rangle \mid \phi \text{ has at least two satisfying assignments} \}. Show that DOUBLE-SAT is NP-complete.