Please group problems as follows: (1 2) (3) (4) (5) (6)

All proofs are informal and intended to develop intuition and expository style, so please provide convincing write-ups of each.

1. [10 points] Sipser book, Problem 3.15 c only:

3.15 Show that the collection of decidable languages is closed under the operation of

   A. union.     D. complementation.
   B. concatenation. E. intersection.
   C. star.

2. [10 points] Sipser book, Problem 3.16 b only:

3.16 Show that the collection of Turing-recognizable languages is closed under the operation of

   A. union.     C. star.
   B. concatenation. D. intersection.

3. [20 points] Sipser book, Problem 3.18:

*3.18 Show that a language is decidable iff some enumerator enumerates the language in lexicographic order.

4. [20 points] Sipser book, Exercise 4.2:

4.2 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.

5. [20 points] Sipser book, Exercise 4.4:

4.4 Let $A_{\varepsilon_{CFG}} = \{ \langle G \rangle \mid G$ is a CFG that generates $\varepsilon \}$. Show that $A_{\varepsilon_{CFG}}$ is decidable.

6. [20 points] Sipser book, Problem 4.10:

4.10 Let $INFINITE_{PDA} = \{ \langle M \rangle \mid M$ is a PDA and $L(M)$ is an infinite language}. Show that $INFINITE_{PDA}$ is decidable.