1. Read Kozen Lectures 34–35. See the posted Reduction examples.

2. Tell whether the following problems are decidable or undecidable. Give a short justification for each.
   
   (a) whether $L(M)$ is r.e., where $M$ is a Turing machine
   (b) whether $L(M) \cap L(M) = \emptyset$, where $M$ is a Turing machine
   (c) whether $L(M) = L(M)^R$, where $M$ is a Turing machine and $L(M)^R$ is the reverse of all the strings in $L(M)$.

3. Show that the set of Turing machines
   
   $TOTAL = \{M \mid M \text{ halts on all inputs}\}$
   
   is not r.e.
   
   Hint: Recall that $HP = \{M \#x \mid M \text{ halts on } x\}$ is r.e. but not recursive, so therefore $\overline{HP}$ is not r.e. Show $\overline{HP}$ reduces to $TOTAL$, i.e., describe a new machine $N = \sigma(M \#x)$ such that $N$ halts on all inputs iff $M$ does not halt on $x$.

4. Show that the sets $A = \{M \mid M \text{ does not halt on } \epsilon\}$ and $B = \{M \mid L(M) = \emptyset\}$ are not r.e.
   
   Hint: Reduce $\overline{HP}$ to one of $A$ or $B$, then reduce that set to the other one.

5. Show that the set $B = \{M \mid M \text{ accepts at least 301 strings}\}$ is r.e. but not co-r.e. (that is, show $B$ is an r.e. set but its complement $\overline{B}$ is not r.e.).

6. Do Kozen Homework 8 (p. 309) #2. [A similar (and harder) problem is posed in #99 (p. 340) of the Miscellaneous Exercises, and a solution is given on p. 368. For your part (a), mimic the solution given for part (a) on p. 368, and the formal definition of Turing machines given in class and in Kozen Lecture 28.]