1. Let $F(x, y)$ be a total computable function from $N \times N$ to $N$. For each $e \in N$, let $g_e(x) = F(e, x)$ for all $x \in N$. Show using diagonalization that there is a total unary computable function $f(x)$ such that $f$ is not in the list $g_0, g_1, g_2, \ldots$.

2. Prove that there is an $\exists \Delta_0$ sentence $A$ such that $\neg A \in TA$ but $PA$ cannot prove $\neg A$.

3. Prove that the set of true $\Delta_0$ sentences is recursive and therefore arithmetical. Show that the set of true $\exists \Delta_0$ sentences is r.e., and therefore arithmetical.

4. (NOT GRADED) Prove that if $\Sigma$ is any sound theory (that is, $\Sigma \subseteq TA$), then $\Sigma$ is not recursive.