1. Show that $\forall y E(x, y) \neq \exists u \exists v y(y = u \lor y = v)$, by giving a structure $\mathfrak{A}$ and (if needed) an object assignment $s$. Explicitly list the members of $|\mathfrak{A}|$ and $E^\mathfrak{A}$. For full credit, choose $|\mathfrak{A}|$ to be as small as possible.

\[ |\mathfrak{A}| = \{0, 1, 2\} \]
\[ E^\mathfrak{A} = \{ <0, 1>, <0, 2> \} \]

with $s(x) = 0$.

2. a. Give the definition of “elementary class in the wider sense ($EC_{\Delta}$)”.

Let $C$ be a collection of structures. $C$ is an $EC_{\Delta}$ iff there is a set $T$ of sentences such that $C = \{ \phi \in \mathcal{L} : \mathfrak{A}, \phi \in T \}$

b. Work in the language containing $=$ (equality) and a unary predicate $P(\cdot)$. Describe a set of sentences illustrating that the class of models $\mathfrak{A}$ in which $P^\mathfrak{A}$ is infinite is an elementary class in the wider sense (an $EC_{\Delta}$).

Let $T'$ be:

\[ \{ \exists x_1 \ldots \exists x_i ( \bigwedge_{j=1}^{i} P(x_i) \land \bigwedge_{j=1}^{i} \bigwedge_{k=1}^{i} x_j \neq x_k) \} \]