Q3).

Proposition:

Let A, B be non-empty sets $A, B \subseteq \mathbb{R}, A \cup B = \mathbb{R}$, and $a < b, \forall a \in A, \forall b \in B$. Then, there exists an $s \in R$ such that $a \leq s \leq b, \forall a \in A, b \in B$. In other words, $P(13) \Rightarrow P(13^{'})$.

Proof:

By the definition of upper bound, B is the set of upper bounds of A, with the possible exception of a maximum in A. That means A has an upper bound. Thus, by the completeness axiom, A has a least upper bound. In other words, $\exists s \in R$ such that $a \leq s, \forall a \in A$ ($s > a$ unless A mas a maximum, in which case $s = A$), and, since it is a least upper bound, $s \leq b, \forall b \in B$ ($s < b$ unless A has a maximum, in which case $s = Min(b)$). So, $a \leq s \leq b, \forall a \in A, b \in B$, meaning that $P(13) \Rightarrow P(13^{'})$.
Next, need to show that $P(13^{'}) \Rightarrow P(13)$.

Proposition:

If $s \in \mathbb{R}$ and S has an upper bound, S has a least upper bound. In other words, $P(13^{'}) \Rightarrow P(13)$.

Proof:

Let $B = \{x \in \mathbb{R} : x > s, \forall s \in S\}$ and $A = \{x \in \mathbb{R} : x \notin b\}$. Since an element of $\mathbb{R}$ is either in B or not in B, $A \cup B = \mathbb{R}$. B is the set of upper bounds of A, save for only the maximum of A, if it exists. Also, $S \subseteq A$, since no element of S is greater than every element of S. From the definition of A, $\forall a \in A, s \in S, a \leq s$ (Because no element of A is bigger than any element of S). This means that if A has a least upper bound, so does S, and the least upper bound of A is equal to that of S. So, if A has a least upper bound, the proof is complete. Apply $P(13^{'})$, so $\exists k \in \mathbb{R} : a \leq k \leq b, \forall a \in A, b \in B$. This is the definition of a least upper bound. So, A has a least upper bound, and therefore, so does S, completing the proof.
Therefore, $P(13^{'}) \Rightarrow P(13)$ and $P(13) \Rightarrow P(13^{'})$, so they are equivalent.