Consider the propositions

$$P: \quad \forall x : F(x, \text{Alice})$$
$$Q: \quad \forall x : (F(x, \text{Alice}) \longrightarrow \forall y : F(x, y)).$$

Here $x, y$ represent people (Alice, Bob, etc.) and $F(x, y)$ stands for "$x$ and $y$ are friends".

(a) Describe the meaning of $P$ and $Q$ in English.

**Solution:** $P$ means "Everyone is friends with Alice." $Q$ means "Everyone who is friends with Alice is also firends with everyone else."

(b) are $P$ and $Q$ logically equivalent? Justify your answer.

**Solution:** No. Consider the world that consists of Alice, Bob, and Charlie who are all mutual strangers. In this world $P$ is false but $Q$ is true.