1. Let $L \subseteq \Sigma^*$ be a regular language. Is

$$L' = \{ u \in \Sigma^* : \exists v \in \Sigma^* \text{ such that } uv \in L \text{ and } |u| = |v| \}$$

necessarily regular? Prove your answer.

2. (Extra credit) Let $L \subseteq \Sigma^*$ be a regular language. Is

$$L'' = \{ uv \in \Sigma^* : \exists w \in \Sigma^* \text{ such that } uwv \in L \text{ and } |u| = |v| = |w| \}$$

necessarily regular? Prove your answer.