Exercise 1(b).

Claim. Let $P$ and $Q$ be sentences. Then $\neg(P \lor Q)$ is logically equivalent to $\neg P \land \neg Q$.

Proof. Assume $\neg(P \lor Q)$ is true. Then $P \lor Q$ is false. Therefore, both $P$ and $Q$ are false. Hence, both $\neg P$ and $\neg Q$ are true. Then $\neg P \land \neg Q$ is true.

Conversely, suppose $\neg P \land \neg Q$ is true. Then both $\neg P$ and $\neg Q$ are true. Therefore, both $P$ and $Q$ are false. Then $P \lor Q$ is false. Hence, $\neg(P \lor Q)$ is true.

Therefore, $\neg(P \lor Q)$ is logically equivalent to $\neg P \land \neg Q$. \qed