1) Use the method of conditional proof to explain in words why the sentence
\[
\{(P \lor Q) \land [(P \implies R) \land (Q \implies S)]\} \implies (R \lor S)
\]
is a tautology. Be explicit about discharging assumptions.

2) Let \( f \) be a continuous function from \( \mathbb{R} \) to \( \mathbb{R} \) and let \( L \in \mathbb{R} \). To say that \( f(x) \) tends to \( L \) as \( x \) tends to \( \infty \) means that for each \( \epsilon > 0 \), there exists \( K \in \mathbb{R} \) such that for each \( x > K \), \( |f(x) - L| < \epsilon \). Use the generalized De Morgan’s laws to show that \( f(x) \) does not tend to \( L \) as \( x \) tends to \( \infty \) iff there exists \( \epsilon > 0 \) such that for each \( K \in \mathbb{R} \), there exists \( x > K \) such that \( |f(x) - L| \geq \epsilon \). Be careful not to skip any steps.

3) Show that for each real number \( x \), \( \pi + x \) is irrational or \( \pi - x \) is irrational.

4) Prove the following statement: let \( x \) be a rational number such that \( x^2 = c \), where \( c \) is a whole number. Then \( x \) is an integer.

5) Prove the following statement: Let \( x \) be a rational number. Then \( x^2 \neq 2 \).