1. Let \( f \) be an analytic map with a fixed point at \( \infty \). Show that the multiplier of \( f \) at \( \infty \) is equal to \( \lambda = \lim_{z \to \infty} \frac{1}{f'(z)} = \lim_{z \to \infty} \frac{z}{f(z)} \).

2. Let \( f \) be a non-constant rational map and let \( K \subseteq \hat{\mathbb{C}} \) be a set.
   (a) Show that \( f^{-1}(K) = K \) implies \( f(K) = K \).
   (b) Give an example to show that \( f(K) = K \) does not imply \( f^{-1}(K) = K \).
   (In other words, for complete invariance it is enough to check \( f^{-1}(K) = K \), but not enough to check \( f(K) = K \).)

3. Let \( f \) be a rational map of degree \( \geq 2 \). Show that the Julia set \( J(f) \) is the smallest completely invariant compact set containing at least three points. I.e., if \( K \) is a compact set containing at least three points with \( f(K) = K = f^{-1}(K) \), then \( J(f) \subseteq K \).

4. Let \( f(z) = z^2 - 2 \). Show that \( J(f) = [-2, 2] \).