(1) Consider the functions \( f, g : \mathbb{R} \to \mathbb{R} \) defined by
\[
    f(x) = \sqrt[3]{x - 1} \quad \text{and} \quad g(x) = x^2.
\]
Find the formulas for \( f \circ g \) and \( g \circ f \).

(2) Find the inverse of the function \( f: \mathbb{R} \setminus \{1/2\} \to \mathbb{R} \setminus \{3/2\} \) with
\[
    f(x) = \frac{3x + 2}{2x - 1}.
\]

(3) Give a proof by induction of the following:

**Theorem.** For \( 1 \leq n \in \mathbb{Z} \), suppose that \( A_1, A_2, \ldots, A_n \) are countably infinite sets. Then
\[
    \bigcup_{i=1}^{n} A_k
\]
is countably infinite.

(4) Prove or disprove the following:

**Claim.** Suppose that \( X \) and \( Y \) are countably infinite sets. Then if \( X \subseteq Z \subseteq Y \), the set \( Z \) is countably infinite.