1. Precise and complete answers are a must for full credit. Show all your work. Calculators are NOT allowed.

1. State/Define the following precisely. \(5 \times 2 = 10\)
   (i) Denumerable set
   (ii) Surjective (onto) function
   (iii) Completeness axiom
   (iv) Archimedean property of \( \mathbb{R} \)
   (v) Divergent sequence

2. Suppose \( S \) is a nonempty subset of \( \mathbb{R} \) and \( k \) is an upper bound of \( S \). Then show that \( k \) is the least upper bound of \( S \) if and only if for each \( \varepsilon > 0 \) there exists a \( s \in S \) such that \( k - \varepsilon < s \). \((5 \text{ points})\)

3. Prove that between any two real numbers there exists an irrational number. \((3 \text{ points})\)

4. Prove that the sequence \( \{a_n\} \) converges to \( A \) if and only if \( \lim_{n \to \infty} (a_n - A) = 0 \). \((5 \text{ points})\)

5. Show that the sequence \( \sqrt{n} \) diverges.