1. a. State the definition of *Cauchy sequence*.
   b. State the definition of a *limit* of a function $f: \mathbb{R} \mapsto \mathbb{R}$ at a point $a \in \mathbb{R}$.
   c. State the definition of *uniformly continuous*.

2. For each of the following subsets of $\mathbb{R}$ find (*without proof*) the set of all limit points.
   a. $(0, 1]$.
   b. $\mathbb{Q}$.
   c. $\{ \frac{n-1}{n} : n \in \mathbb{Z}^+ \}$.
   d. $\{ 2^{-n} : n \in \mathbb{Z} \}$.

3. Working directly from the $\varepsilon$-$\delta$-definition of convergence, show that
   a. every constant sequence converges, and that
   b. the sequence $(a_n)_{n=1}^{\infty}$ defined by $a_n = n^2$ does not converge.

4.a. Suppose that $(a_n)_{n=1}^{\infty}$ and $(b_n)_{n=1}^{\infty}$ are Cauchy sequences.
    Prove that $(a_n - b_n)_{n=1}^{\infty}$ is a Cauchy sequence.

   **Bonus.** Prove that every Cauchy sequence (in a metric space) is bounded.

5. Prove that if $g: \mathbb{R} \mapsto \mathbb{R}$ and $f: \mathbb{R} \mapsto \mathbb{R}$ are continuous functions then $f \circ g$ is continuous.

6. a. Suppose that $f: (-1, 1) \mapsto \mathbb{R}$ is uniformly continuous function.
    Prove that $f$ is bounded.

   b. Give an example that shows that the assumption of *uniform* (continuity) cannot be omitted.