1. Find a $\delta > 0$ such that $|x - 2| < \delta$ implies that $|x^2 + x - 6| < \epsilon$ for a given $\epsilon > 0$.

2. Use an $(\epsilon, \delta)$-type proof to show that the function $f(x) = x \sin(\frac{1}{x})$ if $x \neq 0$ and $f(0) = 0$, is continuous at 0. Show that $f(x)$ is continuous on $\mathbb{R}$ by any method. Is the function $f(x) = \sin(\frac{1}{x})$ uniformly continuous on $(0, \frac{1}{\pi}]$?

3. Find a continuous function $f : D \rightarrow \mathbb{R}$ and a Cauchy sequence $\{x_n\}_{n=1}^{\infty}$ such that $\{f(x_n)\}_{n=1}^{\infty}$ is divergent.

4. Let $f : D \rightarrow \mathbb{R}$ be uniformly continuous on $D$ and suppose that $\{x_n\}_{n=1}^{\infty}$ is a Cauchy sequence in $D$. Show that $\{f(x_n)\}_{n=1}^{\infty}$ is Cauchy.

5. Prove that if $S$ is a non empty compact set then $S$ contains its maximum and its minimum.

6. Is $\bigcap_{n=1}^{\infty} (0, 1 + \frac{1}{n})$ closed or open?

7. Show that if $S$ is an infinite subset of a compact set $K$, then $S$ has a limit point in $K$. (Hint: do a proof by contradiction)

8. Let $E$ be a subset of $\mathbb{R}$ and let $f : E \rightarrow \mathbb{R}$. Show that $f$ is continuous on $E$ if and only if $U \subset \mathbb{R}$ open implies that the preimage $f^{-1}(U) \subset E$ is also open. (Remember that $f^{-1}(U) = \{x \in E : f(x) = y \text{ with } y \in U\}$)