1. Use the “sequential test” to carefully prove that the product of continuous functions is continuous.

2. Suppose that \( \lim_{x \to x_0} f(x) = L_1 \) and \( \lim_{x \to x_0} g(x) = L_2 \), then prove that \( \lim_{x \to x_0} (fg)(x) = L_1 L_2 \), if \( x_0 \) is a limit point of \( \text{dom}(fg) := \text{dom}(f) \cap \text{dom}(g) \).

3. Prove that each finite set is a compact set.

4. Give an example of a closed set which is not compact, and justify your work.

5. Give an example of a bounded set which is not compact, and justify your work.