1. Decide whether \( \mathbb{R} \) with the following functions as proposed metrics make up a real metric space: (a) \( d(x, y) = |x^2 - y^2| \) (b) \( d(x, y) = \frac{|x-y|}{1+|x-y|} \).

2. Let \( Q \) be the set of rational numbers with the usual distance function (e.g. \( d(x, y) = |x - y| \)). Is this a metric space? If yes, is the Heine-Borel theorem still true for this? Prove or disprove.

3. Let \( F : \mathbb{R}^k \to \mathbb{R} \) be a continuous function. Let \( Z(f) = \{ p \in \mathbb{R}^k | f(p) = 0 \} \). Prove \( Z(f) \) is a closed set.

4. Exercise 21.9

5. Exercise 21.10

6. Exercise 22.1

7. Exercise 22.6