Homework # 1 Due Tuesday 2/11/2020 start of class.

1. We have a new definition of continuous for a map $f : \mathbb{R} \rightarrow \mathbb{R}$ using our abstract concept of topology. We have the old $\delta - \epsilon$ version that uses the metric. Prove they are the same.

2. Given a continuous map $f : [0, 1] \rightarrow \mathbb{R}$ with $f(0) < 0 < f(1)$, show that there is an $x \in [0, 1]$ such that $f(x) = 0$.

3. Given a continuous map $f : [0, 1] \rightarrow \mathbb{R}$, show that there is an $x \in [0, 1]$ such that $f(y) \leq f(x)$ for all $y \in [0, 1]$.

4. Given a continuous map $f : [0, 1] \rightarrow [0, 1]$, show that there is an $x \in [0, 1]$ such that $f(x) = x$. 