Least greatest proofs

Prove or **disprove**: There is a least prime number.

Prove or **disprove**: There is a greatest integer.

Approach 1, De Morgan's and universal generalization:

Approach 2, proof by contradiction:

Extra examples: Prove or disprove that $\mathbb{N}$, $\mathbb{Q}$ each have a least and a greatest element. Prove that there is no greatest prime number.