Practice Proofs about Sets

1.

   Proposition. $\{p : p \text{ is a prime number}\} \cap \{k^2 - 1 : k \in \mathbb{N}\} = \{3\}.$

2. Prove this proposition using a proof by contradiction.

   Proposition. $\{2k + 1 : k \in \mathbb{N}\} \cap \{4k : k \in \mathbb{N}\} = \varnothing.$

3.

   Proposition. *Suppose A, B, and C are sets. If $A \subseteq B$ and $A \subseteq C$, then $A \subseteq (B \cap C)$.*

4.

   Proposition. $\mathcal{P}(A \cap B) \subseteq \mathcal{P}(A) \cap \mathcal{P}(B).$