Name: ______________________

Pid: ______________________

1. (8 points) Check all the correct statements.

   ◯ The statement $x \in \{1, 2\}$ implies the statement $x^2 - 3x + 2 = 0$ for all real numbers x.

   ◯ The sets $\{-1, -2\}$, $\mathbb{N}$, $\{\pi\}$ are pairwise disjoint.

   ◯ The sets $\{x \in \mathbb{R} \,:\, \exists y \in \mathbb{Q}\ y^2 = x\}$ is equal to $\mathbb{Q}$.

   ◯ The sets $\{x \in \mathbb{R} \,:\, x \leq 100\}\Delta\{x \in \mathbb{R} \,:\, x \geq -100\}$ is equal to $\emptyset$.

   ◯ The set $\{a, b\} \times \{c, d\}$ is equal to $\{(a, c), (c, a), (b, d), (d, b)\}$.

2. (10 points) Let Ω be some set and $A_1, \ldots, A_n \subseteq \Omega$. Show that $\bigcup_{i=1}^n A_i = \{x \in \Omega \ : \ \exists i \in [n] \ x \in A_i\}$.

3. (10 points) Let $A_1, \ldots, A_n$ be some sets. Show that $\bigcup_{i=1}^{n} (A_i \cap B) = (\bigcup_{i=1}^{n} A_i) \cap B$.

4. (10 points) Show that $A\Delta(B\Delta C) = (A\Delta B)\Delta C$.

5. (10 points) Let us define $n!$ (n is a natural number) such that $1! = 1$ and $(n+1)! = n! \cdot (n+1)$. Show that $\sum_{k=1}^{n} k \cdot k! = (n+1)! - 1$.