Name: _____

Show all work.

1. If p and q are propositions, the contrapositive tautology is that the proposition $p \Rightarrow q$ is equivalent to $\sim q \Rightarrow \sim p$. Use a truth table to prove this.

2. If A and B are sets, prove that $A \cap B = A$ if and only if $A \subseteq B$

3. Construct an explicit counterexample using finite sets to the (false) proposition that for any sets A and B we have $\mathscr{P}(A \cup B) = \mathscr{P}(A) \cup \mathscr{P}(B)$

4. Suppose A, B, C are sets. Prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$

5. For each $n \in \mathbf{N}$ let $A_n \subseteq \mathbf{R}$ be the interval $A_n = [0, \frac{1}{\sqrt{n}})$. Find $\cap \{A_n \colon n \in \mathbf{N}\}$. Prove your assertion.

1	2	3	4	5	total (50)