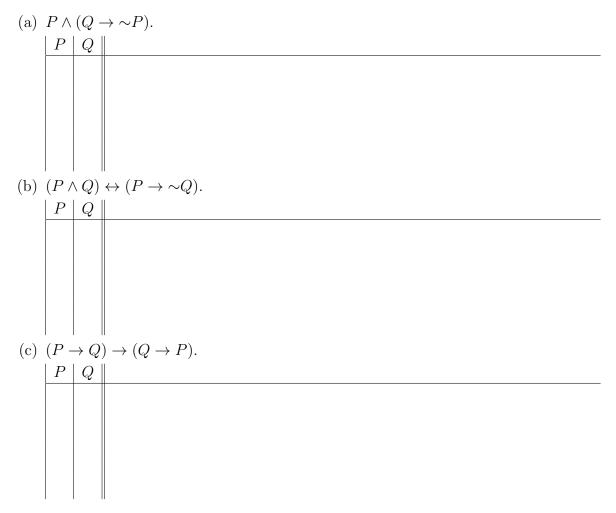
- 1. (7 points) Consider the true statement "For every real number x, if x > 2, then $x^2 > 4$." Write its negation as a quantified statement in words or symbols and briefly explain why this new statement must be false.
- 2. (18 points) Find sets satisfying the conditions below, or briefly explain why it is impossible to find such sets:
 - (a) Sets R, S, and T such that $R \in S, S \in T$, and $S \subsetneq T$.
 - (b) Sets A and B such that $A \subseteq \mathbb{N}, B \subseteq \mathbb{N}$, and $A \in B$.
 - (c) Finite sets X, Y, and Z such that $X \subseteq Z$, $Y \subseteq Z$, |X| = |Y|, and $|X \cap Y| = 2$.
- 3. (19 points) Prove that for any integer n, if $n^2 + 4n + 1$ is even, then n is odd.

4. (8 points) The statement "for any natural number n, if n has an odd number of factors, then it is a perfect square" is true. State its converse. Is the converse true or not? Briefly explain your reasoning.

5. (15 points) Prove that for integers a, b, and c, if a and c are both odd, then ab + bc is even.

6. (15 points) Fill in the truth table for each of the following statements, and identify the statement as a tautology, a contradiction, or neither.



7. (18 points) Prove that for any integer n, $3n^2 - 5n$ is even.