1. **(16 points)** Write out truth tables for each of the following statements (you may write them all in one truth table, if you wish):
   (a) $[\sim(P \vee Q)] \rightarrow \sim Q$.
   (b) $(P \rightarrow Q) \leftrightarrow \sim P$.
   (c) $(P \wedge \sim Q) \vee Q$.
2. **(7 points)** Write the negation of the false statement "There is an even integer n such that $n + 1$ is divisible by 4" as a quantified statement (using a universal or existential quantifier, either in words or in symbols).
3. **(11 points)** Determine the converse of the true statement "For a real number x, if x is positive, then $x^2 + 5x$ is also positive." Is the converse true? Either briefly justify your statement or provide a counterexample.
4. **(18 points)** Prove that for integers a and b, if both ab and $a + b$ are even, then both a and b are even.
5. **(15 points)** Prove that for any integer n, the number $5n^2 + 3n + 7$ is odd.
6. **(10 points)** Prove that if n is even, then $3n - 5$ is odd.
7. **(16 points)** Let $S = \{\emptyset, 2, 3, \{5, 7, 9\}, \{1, 2, 3, 4, \ldots\}\}$. For each of the following descriptions, either produce a set matching the description or explain briefly why such a set doesn't exist.
   (a) A set A of 4 elements such that $A \in S$.
   (b) A set B of 4 elements such that $B \subseteq S$.
   (c) A set C of 4 elements, such that $C \in \mathcal{P}(S)$.
   (d) A set D of 4 elements, such that $D \subseteq \mathcal{P}(S)$.