1. Express the following as predicate formulas then determine their truth values using the specified domain of discourse and predicates.

   (a) The sum of squares of any positive integers is less than the square of their sum. The domain is the set of positive integers, and the predicate is $P(x, y, z) \leftrightarrow (x^2 + y^2 < (x + y)^2)$.

   (b) The average of any two integers is an integer. The domain is the set of (all) integers, and the predicate is $P(x, y, z) \leftrightarrow (x + y = 2z)$.

   (c) Every positive composite integer greater than 1 has a factor (other than 1) at most its square root. The domain is the set of positive integers, and the predicates are $F(f, g, x) \leftrightarrow (fg = x)$, $O(x) \leftrightarrow (x = 1)$, and $L(x, y) \leftrightarrow (x \leq \sqrt{y})$.

2. Express the negations of each of the following so that all negation symbols immediately precede predicates.

   (a) $\forall x \forall y \exists z. A(x, y, z)$

   (b) $\forall g. [A(g) \lor \exists h. [B(g, h) \lor A(h)]]$

3. Prove or disprove the following about any sets $A$, $B$, and $C$.

   (a) $A \setminus B \subseteq A$

   (b) $(A \setminus B) \cap C = (A \cap C) \setminus (B \cap C)$

   (c) $(A \setminus B) \cup C = (A \cup C) \setminus (B \cup C)$

4. The symmetric difference of two sets $A$ and $B$ is denoted by $A \triangle B$ and defined as

   $A \triangle B = (A \setminus B) \cup (B \setminus A)$.

Prove the following:

   (a) $A \triangle B = (A \cup B) \setminus (A \cap B)$

   (b) $A \cup B$ is disjoint from $A \triangle B$

   (c) $A \cap B$ is disjoint from $A \triangle B$