1. Circle the letter before any sentence which is a mathematical statement.

   (a) What time is it?

   (b) $x + 10 = 5$.

   (c) If n is an even integer, then $n + 1$ is also an even integer.

   (d) This sentence is false.

   (e) $\forall x \, \exists y \, (x + y = 12)$.

2. Consider the statement "If Frank has blue eyes, then Ellie has brown eyes." Assume that this statement is true.

   (a) Suppose you know that Frank has green eyes. What can you conclude? Explain.

   (b) Suppose you know that Ellie has blue eyes. What can you conclude? Explain.

3. Consider the statement "If Frank has blue eyes, then Ellie has brown eyes."

   (a) Write the converse of this statement.

   (b) Write the contrapositive of this statement.

4. Consider the statement $\forall x \, \exists y \, (x + y = \sqrt{2})$.

   (a) Give a domain for which this statement is true. (No explanation needed.)

   (b) Give a domain for which this statement is false. (No explanation needed.)

5. Decide if the following are true or false. Circle one. Here, A and B are sets, and $C = \{0, 1, 2, 3, 4\}$. Assume $\mathcal{U}$ is the set of all integers.

   (a) TRUE FALSE If $A \subseteq B$, then $A \subset B$.

   (b) TRUE FALSE $C \subset \mathbb{N}$.

   (c) TRUE FALSE $C \subset C$.

   (d) TRUE FALSE $\{2, 3\} \in C$.

   (e) TRUE FALSE $\emptyset \subset C$.

6. Let $A = \mathbb{N}$, $B = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $C = \{3, 6, 9, 12\}$, and $D = \{1, 3, 5, 7, 9\}$, with universe $\mathcal{U} = \mathbb{Z}$. Find:

   (a) $D \cap \overline{A}$.

   (b) $B \setminus D$.

   (c) $\overline{B \cup D}$.

   (d) $A \cup \overline{A}$.

   (e) $B \cap \overline{C \cup D}$.

7. Using Venn diagrams, decide if the statement $A \cup (B \cap \overline{A}) = (A \setminus B) \cup (B \setminus A)$ is true or false.