1. Using statements about membership prove or disprove the following statement about sets $A$ and $B$: $A \cap B^c \subseteq (A \cap B)^c$.

2. Suppose that the forecast is that it will rain only if the pressure is low.
   (a) If the pressure is low will it rain?
   (b) If the pressure is high will it rain?

3. Let $A$ be the set of all natural numbers that are divisible by 3; let $B$ be the set of all natural numbers that are not divisible by 3. Prove that $A$ and $B$ have the same cardinality.

4. The Sheffer Stroke is a logical operation (denoted by $\uparrow$) that is defined by the table below. Write the truth table for $(A \uparrow B) \uparrow (B \uparrow A)$.

\[
\begin{array}{c|c|c}
P & Q & P \uparrow Q \\
T & T & F \\
T & F & T \\
F & T & T \\
F & F & F \\
\end{array}
\]

5. Give an example of a relation on $A = \{1, 2, 3, 4\}$ that is symmetric and transitive but not reflexive. Prove that your example has required properties.

6. Let $f : A \to B$ and $g : B \to C$. Prove or disprove: If $g$ is surjective then $g \circ f : A \to C$ is surjective.

7. Six men and two women have to form a line in front of the ticket office. In how many ways can they do it so that the two women are together.

8. A number, written in a system base 6, has the form 123412341234...1234 so that it has altogether 2000 digits. Prove that it is divisible by 5. Is it divisible by 10?