1. Let A and B be sets. Show that the following are equivalent:

(1) $A \subseteq B$.

(2) $A \cap B = A$.

(3) $A \setminus B = \varnothing$.

2. Show that for any sets A and B, $A \subseteq B$ if and only if $\mathcal{P}(A) \subseteq \mathcal{P}(B)$.

3. Let $A = \{1, 2, 3\}$ and let $B = \{1, 4\}$. Find

(a) $\mathcal{P}(A)$.

(b) $\mathcal{P}(B)$.

(c) $\mathcal{P}(A \cap B)$.

(d) $\mathcal{P}(A \cup B)$.

4. (a) Show that for any sets A and B, $\mathcal{P}(A \cap B) = \mathcal{P}(A) \cap \mathcal{P}(B)$.

(b) Give an example of sets A and B such that $\mathcal{P}(A \cup B) \neq \mathcal{P}(A) \cup \mathcal{P}(B)$.