For these problems, you should justify your answers. You do not need to provide a rigorous mathematical proof, but rather an informal argument.

Problem 1. Let A and B be sets.

(i) Under what conditions do we have $A \times B = B \times A$?
(ii) When is it true that $|\mathscr{P}(A) \times \mathscr{P}(A)| = |\mathscr{P}(A \times A)|$?
(iii) What can you conclude if $A - B = \varnothing$?
(iv) Describe in words the set $X = (A \times A) - D$, where the subset $D \subseteq A \times A$ is given by $D = \{(a, a) : a \in A\}$.

Solution. □

Problem 2. Determine whether each of the following is true or false; justify your answer.

(i) $\mathbb{R}^2 \subseteq \mathbb{R}^3$
(ii) $A \times \varnothing = \varnothing$ for every set A.
(iii) If $A \subseteq B$, then $\mathscr{P}(A) \subseteq \mathscr{P}(B)$.
(iv) If $\mathscr{P}(A) \subseteq \mathscr{P}(B)$, then $A \subseteq B$.

Solution. □