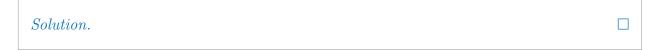
For these problems, you should justify your answers. You do not need to provide a rigorous mathematical proof, but rather an informal argument.

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 $A B = \emptyset$?
- (iv) Describe in words the set $X = (A \times A) D$, where the subset $D \subseteq A \times A$ is given by $D = \{(a, a) : a \in A\}$.



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

- (i) $\mathbb{R}^2 \subseteq \mathbb{R}^3$
- (ii) $A \times \emptyset = \emptyset$ 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 $A \subseteq B$.

 \square