

Exercise 1. Let $f : X \rightarrow Y$ be a map with $A_1, A_2 \subset X$ and $B_1, B_2 \subset Y$. Show that

$$f(A_1 \cup A_2) = f(A_1) \cup f(A_2) .$$

Exercise 2. Let $f : X \rightarrow Y$ be a map with $A_1, A_2 \subset X$ and $B_1, B_2 \subset Y$. Show that

$$f(A_1 \cap A_2) \subset f(A_1) \cap f(A_2) .$$

Exercise 3. Let $f : X \rightarrow Y$ be a map with $A_1, A_2 \subset X$ and $B_1, B_2 \subset Y$. Show that

$$f^{-1}(B_1 \cup B_2) = f^{-1}(B_1) \cup f^{-1}(B_2) ,$$

where $f^{-1}(b) = \{x \in X : f(x) = b\}$.

Exercise 4. Let $f : X \rightarrow Y$ be a map with $A_1, A_2 \subset X$ and $B_1, B_2 \subset Y$. Show that

$$f^{-1}(B_1 \cap B_2) = f^{-1}(B_1) \cap f^{-1}(B_2) .$$

Exercise 5. Let $f : X \rightarrow Y$ be a map with $A_1, A_2 \subset X$ and $B_1, B_2 \subset Y$. Show that

$$f^{-1}(Y \setminus B_1) = X \setminus f^{-1}(B_1) .$$