

## MATH 250 HANDOUT 13 - IMAGES AND PREIMAGES

Let  $f: A \rightarrow B$  be a function and let  $X, Y \subset A$ . Prove or disprove each of the following:

- (1)  $X \subset Y \Rightarrow f(X) \subset f(Y)$ .
- (2)  $X \subset Y \Leftarrow f(X) \subset f(Y)$ .
- (3)  $f(X \cup Y) \subset f(X) \cup f(Y)$ .
- (4)  $f(X \cup Y) \supset f(X) \cup f(Y)$ .
- (5)  $f(X \cap Y) \subset f(X) \cap f(Y)$ .
- (6)  $f(X \cap Y) \supset f(X) \cap f(Y)$ .
- (7)  $f(X) - f(Y) \subset f(X - Y)$ .
- (8)  $f(X) - f(Y) \supset f(X - Y)$ .

Let  $f: A \rightarrow B$  be a function and let  $X, Y \subset B$ . Prove or disprove each of the following:

- (9)  $f^{-1}(X \cup Y) \subset f^{-1}(X) \cup f^{-1}(Y)$ .
- (10)  $f^{-1}(X \cup Y) \supset f^{-1}(X) \cup f^{-1}(Y)$ .
- (11)  $f^{-1}(X \cap Y) \subset f^{-1}(X) \cap f^{-1}(Y)$ .
- (12)  $f^{-1}(X \cap Y) \supset f^{-1}(X) \cap f^{-1}(Y)$ .
- (13)  $X \subset f^{-1}(f(X))$ .
- (14)  $X \supset f^{-1}(f(X))$ .
- (15)  $X \subset f(f^{-1}(X))$ .
- (16)  $X \supset f(f^{-1}(X))$ .