Math 4310 Introduction to Analysis
Homework Set 1

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Problem 1: Let $f : X \to Y$ and $g : Y \to Z$ be mappings. Prove the following claims:
a) If f and g are injective, then $g \circ f$ is injective as well.
b) If f and g are surjective, then $g \circ f$ is surjective, too.

(4P)

Problem 2: Let $f : X \to Y$ be a mapping, and $A, B \subset Y$. Show that then

$$f^{-1}(A \cap B) = f^{-1}(A) \cap f^{-1}(B)$$
$$f^{-1}(A \cup B) = f^{-1}(A) \cup f^{-1}(B).$$

Determine, whether the following equalities are true for subsets $C, D \subset X$:

$$f(C \cap D) = f(C) \cap f(D)$$
$$f(C \cup D) = f(C) \cup f(D).$$

(6P)

Problem 3: Prove the following statements for all positive integers:
a) $1 + 3 + 5 + \cdots + (2n - 1) = n^2$,

b) $1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$.

(6P)