Problem 1
Let A, B be subsets of some universal set U. Prove that $A \setminus B^C = A \cap B$.

Problem 2

1. Let $S = \{1, 2, 3\}$. List all subsets of S.
2. Let S be a finite set with n elements. How many distinct subsets of S are there?

Problem 3
Let $f : (2, \infty) \to \mathbb{R}$, $f(x) = \dfrac{x+1}{x^2-4}$. Prove that the range of f, $f((2, \infty))$, is $(0, \infty)$.

Problem 4
Find an example of a function $f : A \to B$ and sets $C, D \subseteq A$ such that $f(C \cap D) \neq f(C) \cap f(D)$.

Problem 5
Let A be the "set of all sets". Define $S = \{X \in A : X \notin X\}$. Identify a logical contradiction, assuming the existence of S.[a]

[a] This contradiction is called **Russell's Paradox**, which arises due to our informal and loose definition of a "set" as a collection of distinct objects. In this course, you won't have to worry about such malicious examples of "sets", but it may be helpful to remember that MAT102 presents a simplified but workable version of set theory.

One way to avoid Russell's Paradox is to use a more formal axiomatic definition of "set", such as the **Zermelo-Frankel Axioms (ZF)**. Under the ZF axioms, sets can't be a members of themselves ($X \notin X$ for all sets X).