

Homework 1

MATH 348

due at 11pm on Tuesday, September 22, 2026

Solve the following problems and communicate your solutions clearly using complete sentences. Your proofs may rely on definitions and theorems stated in the text or given in class.

Remember what the syllabus says about appropriate collaboration, and document what sources you use and what assistance you receive as you work on this homework.

For this first homework, you must type your solutions to at least the first three problems in L^AT_EX. You may type or write your solutions to the remaining problems. Make sure your solutions are easy to read, in order, and clearly labeled. Upload a single file containing your solutions to the [Homework 1](#) assignment on Moodle.

Some of the problems will be graded in detail, and the rest will be graded for completion.

1. (6 points) Prove that $(A \cap B) \cup (A - B) = A$. Specifically, your proof should involve the following steps.

First, show that $(A \cap B) \cup (A - B) \subset A$. (Start with some element x in $(A \cap B) \cup (A - B)$ and show that this element is in A .)

Second, show that $A \subset (A \cap B) \cup (A - B)$.

Finally, state your conclusion.

2. (5 points) Exercise 2.1 in the text
3. (5 points) Exercise 2.2 in the text
4. (5 points) Exercise 2.4 in the text
5. (4 points) Exercise 2.5 in the text
6. (3 points) Exercise 2.6 in the text
7. (6 points) Exercise 2.7 in the text: the ϵ - δ part is optional, but the open set part is required. To earn full credit, produce a well-written solution that clearly explains your logical reasoning.
8. (6 points) Let $f: A \rightarrow B$, and let $A_0 \subset A$ and $A_1 \subset A$.
 - (a) Show that $f(A_0 \cap A_1) \subset f(A_0) \cap f(A_1)$.
 - (b) Find an example of a function f and sets A_0 and A_1 such that $f(A_0) \cap f(A_1) \not\subset f(A_0 \cap A_1)$.
 - (c) Compare/contrast parts (a) and (b) with the statement of Lemma 2.8 (specifically part i) in the text.