Math 215: Introduction to Advanced Mathematics
Problem Set 5

Due Friday October 11

Do the following problem from the text: pg 115: 3

1) Prove that \( A - (B \cap C) = (A - B) \cup (A - C) \).

2) Prove that \( A \cap (B \cup C) = (A \cap B) \cup C \) if and only if \( C \subseteq A \).

3) Let \( A \) and \( B \) be subsets of a universal set \( U \).
   a) Prove that \( B \subseteq A^c \) if and only if \( A \cap B = \emptyset \).
   b) Using a) and taking complements, prove that \( A^c \subseteq B \) if and only if \( A \cup B = U \).
   c) Deduce from a) and b) that \( B = A^c \) if and only if \( A \cap B = \emptyset \) and \( A \cup B = U \).

4) a) Prove that \( (A \times B) \cup (C \times D) \subseteq (A \cup C) \times (B \cup D) \).
   b) Give examples showing these sets need not be equal.