

Math 305 Fall 2011  
Assignment #1

This assignment is due at the beginning of class on Thursday, September 15, 2011.

1. Read Section 5 on pages 36–45 and do practice problems 5.2, 5.6, 5.9, 5.11, 5.12, 5.14, 5.15, and 5.18. Solutions may be found on pages 45–46.
2. Suppose that  $A$  is a set. Carefully prove that  $(A^c)^c = A$ .
3. Suppose that  $A$ ,  $B$ , and  $C$  are sets. Carefully prove that
  - (a)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ , and
  - (b)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ .

*Note that these are sometimes called the distribution laws for sets.* An outline to the solution to (a) may be found on page 43. Notice that the text's proof is written out in full sentences and that no symbols or abbreviations are used.

4. Suppose that  $A$  and  $B$  are sets. Carefully prove that  $A \cup B = (A \setminus B) \cup (A \cap B) \cup (B \setminus A)$ . It might be easier to note that  $A \setminus B = A \cap B^c$  and then use the distribution laws to prove the required statement, as opposed to proving the statement directly by showing both containments.
5. Suppose that  $\{A_j : j \in J\}$  is an arbitrary family of sets indexed by  $J$ . Carefully prove that

$$\left( \bigcup_{j \in J} A_j \right)^c = \bigcap_{j \in J} (A_j^c).$$

6. Problem #5.25 on page 49. The solution to (a) is on page 365.