1. Give answers to the following questions.

A. Let $A = \{1, 2, 3, 4, 5\}$ and let $B = \{4, 5, 6, 7\}$. List the members of the following sets.

   (a) $A \cup B$
   (b) $A \cap B$
   (c) $A \setminus B$
   (d) $B \setminus A$
   (e) $A \times B$
   (f) $B \times A$

B. State whether the following are True or False. If False then provide a counter example.

   (a) $A \setminus (B \setminus C) = (A \setminus B) \setminus C$
   (b) $(A \setminus B) \setminus C = (A \setminus C) \setminus B$
   (c) $(A \cup B) \setminus C = (A \setminus C) \cap (B \setminus C)$
   (d) $|A \setminus B| = |A| - |B|$
   (e) $(A \setminus B) \cup B = A$
   (f) $(A \cup B) \setminus B = A$

2. John, Jim, Jay, and Jack have formed a band consisting of 4 instruments. If each of the boys can play all 4 instruments, how many different arrangements are possible? What if John and Jim can play all 4 instruments, but Jay and Jack can each play only piano and drums?
3. Answer the following questions. No justification is needed.

A. In how many ways can 3 boys and 3 girls sit in a row?

B. In how many ways can 3 boys and 3 girls sit in a row if the boys and the girls are each to sit together?

C. In how many ways if only the boys must sit together?

D. In how many ways if no two people of the same sex are allowed to sit together?

4. Bob goes to a shop to purchase a lottery ticket. Suppose that the lottery tickets available at that store are numbered 1, 2, 3, \ldots, 6000. Over the years Bob has found that tickets with even numbers, tickets with numbers that are divisible by 3, and tickets with numbers that are divisible by 5 have been unlucky for him. How many tickets have numbers that Bob thinks are lucky for him?