1. [10 pts. each] Express each set in roster form. (Note: $\mathbb{N}$ is the set of natural numbers.)

   (a) The set of integers between -3 and 4.

   (b) $A = \{x \mid x \in \mathbb{N} \text{ and } 3 < x \leq 14\}$

   (c) $B = \{x \mid 2x + 3 = 1\}$

2. [10 pts. each] Express each set in set-builder notation.

   (a) $C = \{4, 5, 6, 7, 8, 9, 10, 11, 12\}$.

   (b) D is the set of odd natural numbers.

3. [5 pts. each] State whether each statement is true or false. If false, give the reason.

   (a) $\{\#\} \in \{\$, \&, \%, @, \#, =\}$

   (b) $\{\zeta, \alpha\} \subset \{\alpha, \beta, \gamma, \delta, \epsilon, \zeta\}$

   (c) $\boxdot \subset \{\boxdot, \square, \boxdot, \boxslash, \boxdot, \boxast\}$

4. [10 pts.] List all the proper subsets of the set $\{a, b, c\}$.

5. [10 pts. each] Determine each set, given that

$$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8\}$$
$$A = \{1, 2, 4, 5, 8\}$$
$$B = \{3, 4, 7\}$$

   (a) $(A \cup B)'$

   (b) $A' \cup (A \cap B)$

   (c) $A - B'$

6. [10 pts. each] Determine each set, given that

$$U = \{x \mid x \in \mathbb{N} \text{ and } x < 10\}$$
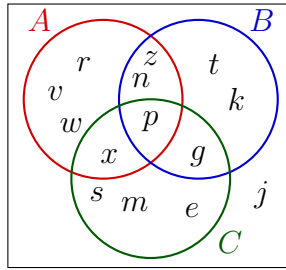$$A = \{x \mid x \in \mathbb{N}, \ x \text{ is odd, and } x < 10\}$$
$$B = \{x \mid x \in \mathbb{N}, \ x \text{ is even, and } x < 10\}$$
$$C = \{x \mid x \in \mathbb{N} \text{ and } 6 < x < 10\}$$

   (a) $(C' \cup A) \cap B$

   (b) $(A - B)' - C$

7. [15 pts.] For $A = \{q, r\}$ and $B = \{4, 6, 8\}$, determine $B \times A$. Also, determine $n(A)$, $n(B)$, and $n(B \times A)$.

8. [10 pts.] Use the Venn diagram below to determine the sets $A \cap (B \cup C)$ and $(A' \cup B) \cap C$.

9. [10 pts. each] Using one of the two methods demonstrated in class, determine whether the following expressions are equal for all sets A, B, and C.

(a) $(A' \cap B)'$, $\quad A \cup B'$

(b) $A \cup (B \cap C)'$, $\quad A' \cap (B \cup C)$

10. Three major grain crops raised in the world are wheat, maize, and rice. A survey of 43 countries that raise grain yielded the following results:

18 countries raised wheat
16 countries raised maize
12 countries raised rice
9 raised wheat and maize
3 raised maize and rice
3 raised wheat and rice
2 raised all three crops

(a) [8 pts.] Draw a Venn diagram illustrating the information given above.
(b) [3 pts.] How many countries raised none of the three crops?
(c) [3 pts.] How many countries raised exactly one of the crops?
(d) [3 pts.] How many raised wheat and maize, but not rice?
(e) [3 pts.] How many raised maize or rice, but not wheat?

11. [10 pts.] Show the set $\{5, 9, 13, 17, 21, \ldots\}$ is infinite by placing it in a one-to-one correspondence with a proper subset of itself. Show the pairing of the general terms of the sets.