NAME:

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

 (a) The set of integers between 2 and 7.

 (b) $E = \{x \mid x \in \mathbb{N} \text{ and } x \text{ is even}\}$

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

 (a) $A = \{5, 6, 7, 8, 9, 10, 11, 12, 13, 14\}$.

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

3. [5 pts. each]   State whether each statement is true or false. If false, give the reason. (Note: the symbol $\varnothing$ represents the empty set.)

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

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

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

 (d) $\varnothing \subset \varnothing$

4. [10 pts.]   List all the proper subsets of the set $C = \{\oslash, \sqcup, \times\}$.

5. [10 pts. each]   Let $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$ be the universal set, $A = \{1, 2, 4, 5, 8\}$, and $B = \{2, 3, 4, 6\}$. Determine the following.

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

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

 (c) $A - B'$

6. [15 pts.]   Determine $(C' \cup A) \cap B$, given that
$U = \{x \mid x \in \mathbb{N} \text{ and } x < 10\}$
$A = \{x \mid x \in \mathbb{N}, \ x \text{ is odd, and } x < 10\}$
$B = \{x \mid x \in \mathbb{N}, \ x \text{ is even, and } x < 10\}$
$C = \{x \mid x \in \mathbb{N} \text{ and } x < 6\}$

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 $(A' \cup B) \cap C$.
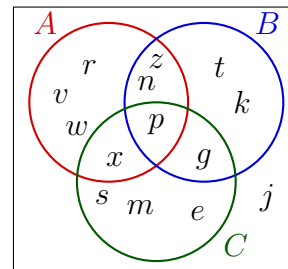
9. [10 pts. each]   Use Venn diagrams to determine whether the following expressions are equal for all sets A, B, and C.

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

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

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) [10 pts.]   Draw a Venn diagram illustrating the information given above.

 (b) [5 pts.]   How many countries raised none of the three crops?

 (c) [5 pts.]   How many countries raised exactly one of the crops?

 (d) [5 pts.]   How many raised wheat and maize, but not rice?

(e) [5 pts.] How many raised maize or rice, but not wheat?

11. [10 pts.] Show that the set $\{3, 8, 13, 18, 23, ...\}$ is infinite by placing it in a one-to-one correspondence with a proper subset of itself. Be sure to show the pairing of the general terms in the sets!

12. [10 pts.] Show that the set $\{1, 3, 5, 7, 9, ...\}$ has cardinal number $\aleph_0$ by establishing a one-to-one correspondence between it and the set of natural numbers. Be sure to show the pairing of the general terms in the sets!