HOMEWORK 1

1) Write each of the following sets by listing the elements with braces.
   a) $A = \{x \in \mathbb{R} : x^2 = 2\}$
   b) $B = \{n \in \mathbb{Z} : n^3 < 30\}$
   c) $C = \{x \in \mathbb{R} : x^2 + 1 = 0\}$
   d) $D = \{n \in \mathbb{N} : |n| \leq 7\}$
2) Write each of the following sets in the form $\{x \in S : p(x)\}$ where $p(x)$ is a property on x and $S = \{-3, -2, 0, 1, 2, 5\}$.
   a) $A = \{0, 1\}$
   b) $B = \{-3, -2\}$
   c) $C = \{-2, 2\}$
   d) $D = \{-3, 5\}$
3) Give examples of sets A, B, and C such that the following hold. In each example it must be clear to the grader that you understand the properties required.
   a) $A \subset B$, $B \in C$, and $A \notin C$
   b) $A \in B$, $B \in C$ and $A \subseteq C$
   c) $B \in A$, $B \subset C$, and $A \cap C \neq \phi$
   d) $A \in B$, $B \subseteq C$ and $A \not\subseteq C$
4) Let $A = \{\phi, \{\phi\}, \{\{\phi\}\}\}$. (For $d - g$ determine the set indicated.)
   a) List the elements of A.
   b) Determine $|A|$.
   c) List all possible subsets of A.
   d) $\phi \cap A$
   e) $\{\phi\} \cap A$
   f) $\{\phi\} \cup A$
   g) $\{\phi, \{\{\phi\}\}\} \cup A$
5) Give an example of a universal set U, two sets A and B, and a Venn diagram such that $|A \cap B| = |A - B| = |B - A| = |A \bar{\cup} B| = 1$.
6) Let A and B be sets in some unknown universal set U. Suppose $\bar{A} = \{3, 8, 9\}$, $A - B = \{1, 2\}$, $B - A = \{8\}$, and $A \cap B = \{5, 7\}$. Determine A, B, and U.
7) Which of the following are true? Explain each of your answers.
   a) $\{1, 2, 3\} = \{2, 3, 1\}$
   b) $\phi \subseteq \phi$
   c) $\phi \in \phi$
   d) $\phi = \{\phi\}$
   e) $3 \subseteq \{3\}$
   f) $\phi \subset \{\phi\}$
   g) $\phi \in \{1, 2, 3\}$
8) Negate each of the following. You should remove 'not' from your sentences.
   a) π is irrational.
   b) One is not a positive number.
   c) 32 is composite.
   d) Seven is prime.