1. Let $A = \{2, 4, 6, 8\}$. Classify each of the following as true, false, or meaningless.

   (a) $4 \in A$

   (b) $4 \subset A$

   (c) $\{4\} \in A$

   (d) $\{4\} \subset A$

   (e) $A \in A$

   (f) $|A| \in A$

2. Let A be any set. Classify each of the following as always true, sometimes false, or meaningless.

   (a) $\emptyset \in A$

   (b) $\emptyset \subseteq A$

   (c) $A \in \mathcal{P}(A)$

   (d) $A \subseteq \mathcal{P}(A)$

   (e) $\emptyset \in \mathcal{P}(A)$

   (f) $\emptyset \subseteq \mathcal{P}(A)$

3. Are the following statements true for all sets A and B? If so, explain why. If not, give a counter-example.

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

   (b) $A \cap B \subseteq B$

   (c) $A \subseteq A \cup B$

   (d) $A \subseteq A \cap B$