Math 300 Intro Math Reasoning
Worksheet 03: Set Theory

(0) $A = \{1, 2, 3\}$, $B = \{1, 1, 2, 3\}$, $C = \{n \in \mathbb{N} \mid \exists y \in \mathbb{R}(|y| + |3 - n| \leq 3)\}$,
$D = \{\{1\}, \{1, 2\}, \{1, 2, 3\}\}$, $E = \{1, \{1, 2, 3\}, 3\}$ $F = \{2^n - m \mid n \in \mathbb{N}, m \in \{0, 1\}\}$

No need to justify the following

(1) How many elements are in each of the sets? (a number or ∞)
(2) Determine if
  (a) $A = B$.
  (b) $A \subseteq E$.
  (c) $A \in E$.
  (d) $A = C$.
  (e) $A \subseteq C$
  (f) $E \subseteq D$.
  (g) $A \subseteq F$
  (h) $C \subseteq F$

We define for every $A \subseteq \mathbb{R}$ and $r \in \mathbb{R}$

$$A + r = \{a + r \mid a \in A\}$$

(1) Compute (no proof):

(1) $\{1, 5\} + 0.5$.
(2) $\mathbb{N} + 1$.
(3) $\mathbb{Z} + 1$.
(4) $\emptyset + r$.

(2) Prove or disprove:

(1) If $A \subseteq B$ then $A + r \subseteq B + r$.
(2) If for some $r, s \in \mathbb{R}$, $A + r \subseteq B + s$ then $A \subseteq B$.
(3) $A + 0 = A$

(3) Prove that for every $r \in \mathbb{R}$, $\mathbb{Q} + r = \mathbb{Q}$ if and only if $r \in \mathbb{Q}$.