# Exercises 12.5

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1. Use Roster notation for

$A = \{x \mid x^2 - 1 = 0\}$
r.n → $\{-1, 1\}$

$B = \{x \mid (x-1)^2 = 0\}$
r.n → $\{1\}$

$C = \{x \mid x + 8 = 9\}$
r.n → $\{1\}$

$D = \{x \mid x^3 - 2x^2 + x = 2\}$
r.n → $\{2,$

$(x-2)$

2. $B \subseteq A$, $B \subseteq C$, $C \subseteq A$, $C \subseteq A$

3. Prove $A \subset B$. $A = \{1\}$, $B = \{1, 2\}$

① $\forall_x \in A \rightarrow x \in B$
② $A \neq B$
Therefor $A \subset B$ and $A \subseteq B$. ◻

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Prove $A \subseteq B$, where $A = \{1\}$ and $B = \{1, 2\}$.

① $\forall_x \in A \rightarrow x \in B$ * whenever every element of A also belongs to B.

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Disprove $A \in B$,

① $\forall_x \in B \rightarrow x \neq A$

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Prove $1 \in A$.

① $1 \in B$.
$B \subseteq A$
Therefor $1 \in A$, or B could not be a subset of A.

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Disprove $1 \subseteq A$.

A is a set, 1 is a number.
Subsets are not possible with numbers.

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7. Prove the following

a) $\{a, a\} = \{a\}$

Sets are equal when every element from every set can be found in every other set.

Let $A = \{a, a\}$
Let $B = \{a\}$

$|A| = |B| = |A \cup B|$.

b) $\{a, b\} = \{b, a\}$

$\forall_x \in B \rightarrow x \in A$
$\forall_x \in A \rightarrow x \in B$

c) $\{a\} = \{b, c\}$
$A = \{a\}$
$B = \{b, c\}$

$\forall_x \in A \rightarrow \exists_y \in B,\ x = y$

And vice-versa.

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8. Commutative laws: $A \cup B = B \cup A$, $A \cap B = B \cap A$

- $A \cup B$, is the result of combining elements in A, B or in Both.

$C = A \cup B \rightarrow \forall_x \in C,\ x \in A \,\|\, x \in B$
$\Leftrightarrow D = B \cup A \rightarrow \forall_x \in D,\ x \in A \,\|\, x \in B$
$\Leftrightarrow \forall_z \in D\ \&\&\ \forall_z \in C$

- Associative Laws, $A \cup (B \cup C) = (A \cup B) \cup C$

$\forall_x \in A \rightarrow x \in A \cup (B \cup C),\ x \in (A \cup B) \cup C$
" " B → " "
" " C → " "
$\forall_x \notin A \setminus B \setminus C \rightarrow x \in A \cup (B \cup C),\ x \in (A \cup B) \cup C$

- Distributive Laws, $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$\forall_x \in A$ AND ($x \in B$ OR $x \in C$) → ($x \in B$ OR $x \in C$) AND $x \in A$