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Set theory

→ the fundamental units of math are "sets"

→ sets are unsorted & unique.

$F := \{Jane, Mary, Susan, Dana\}$

denotes ↗ ↖ "defines"

the set, "RHS"

$M := \{Dana, Bob, Joe, Max\}$

→ sets can have infinite elements

e.g $\mathbb{N} := \{1, 2, 3, \ldots\}$ (natural #s)

$\mathbb{Z} := \{\ldots, -2, -1, 0, 1, 2, \ldots\}$ (integers)

Operators on sets

→ element operators

$Jane \in F$ "Jane is an element of the set F"

element ↑ set ↑

$Joe \notin F$ "Joe is not an element of the set F"

$\{Jane, Mary\} \subseteq F$ "the set {Jane, Mary} is a subset of set F"

subset ↑

→ subset: all elements of the set on LHS are in the set on the RHS.

$\{Joe, Mary\} \not\subseteq F$ "there exists at least one element on the LHS that DNE on the RHS."

let $F' := \{Jane, Mary, Susan, Dana\}$

$F = F'$

→ set equality: $F \subseteq F' \neq F' \subseteq F$

$\{Jane, Mary\} \neq F$ * F isn't a subset of $\{Jane, Mary\}$

$\{Jane, Mary\} \subset F$ * not equal
proper subset

→ proper subset: LHS is a subset of RHS, but RHS isn't a subset of LHS

ex. ① $\{Jane\} \overset{?}{\subset} F$ (true)
② $\{Jane\} \overset{?}{\in} F$ (false)

the SET $\{Jane\}$ isn't in the set F, only the ELEMENT Jane.

③ $Jane \overset{?}{\in} F$ (true)
④ $Jane \overset{?}{\subset} F$ (false)
not defined

$\in, \notin, =, \neq, \subset, \subseteq$ - predicate functions that return T/F.
ex. $\in(Jane, F) =$ true.

Set Functions * return sets:
$F \cup M = \{Jane, Mary, Susan, Dana,$
union $Bob, Joe, Max\}$

* doesn't include duplicates.
ex. ① $\{Dana\} \cup \{Dana\} = \{Dana\}$
② $Dana \overset{?}{\in} M \cup F$ (true)
③ $\mathbb{N}_0 := \mathbb{N} \cup \{0\} = \{0, 1, 2, 3, \ldots\}$

$F \cap M = \{Dana\}$

intersection

* elements that appear in both sets.

ex. ① $F \cap \{Bob, Joe\} = \emptyset$

$\emptyset := \{\}$, null set

② A, B both have ∞ elements.

can $A \cap B = \emptyset$?

∴ yes, if A = even #s & B = odd #s.

③ $\emptyset \subseteq F$ (true) * all sets contain empty set

④ $\emptyset \in F$ (false) * in this case, $\emptyset$ not added as an element of F.