∪ S: the union of all sets in S
∩ S: the and of all sets in S.
power set: the empty set is the subset of any power set.
        elements in a power set are all sets.
        so in a power set, $A = \{a\}$ $P(A) = \{\{\}, \{a\}\}$
    => $\{a\} \in P(A)$ $\{\phi\} \notin P(A)$ $A \in P(A)$
        $\{a\} \subseteq P(A)$ $\phi \subseteq P(A)$ $A \subseteq P(A)$.

any set $\times \{\} = \{\}$, no matter the order.
$A \times \{\} = \{\} \times A = \{\}$.

reflexive: if $a \in A$, then $(a,a) \in R = A \times A$.
symmetric: if $(a,b) \in R$, then $(b,a) \in R$.
transitive: if $(a,b) \in R$, $(b,c) \in R$, then $(a,c) \in R$

existence: give out a specific value
uniqueness: suppose a variable that satisfy the question.