Prove the second absorption law from Table 1 by showing that if A and B are sets, then $A \cap (A \cup B) = A$.

Proof:

Often, objects of a similar nature or with a common property are collected into sets. Each member is called an element of the set. There should be only one of each member (all members are unique). A is a set, and a is an element in A. Same with B and b. When we say an element a is in a set A, we use the symbol ∈ to show it. Two sets can be "added" together. The union of A and B, denoted by $A \cup B$, is the set of all things that are members of either A or B. The union $A \cup B$ of A and B is defined by: $A \cup B = \{x : x \in A \, or \, x \in B\}$.

A new set can also be constructed by determining which members two sets have "in common". The intersection of A and B, denoted by $A \cap B$, is the set of all things that are members of both A and B. If $A \cap B = \emptyset$, then A and B are called disjoint. The intersection $A \cap B$ of A and B is defined by: $A \cap B = \{x : x \in A \, and \, x \in B\}$.

When we define a set, if we take pieces of that set, we can form what is called a subset. A is a subset of B if and only if every element of A is in B.

$A \cap (A \cup B)$ is a subset of A, x is an element in $A \cap (A \cup B)$, also x is an element in A by definition of intersection. Accordingly $A \cap (A \cup B)$ is a subset of A. Another we can write:

$x \in A \cap (A \cup B) \leftrightarrow x \in A$ and $x \in A \cup B$

$\leftrightarrow x \in A$ and $[x \in A \, or \, x \in B]$

$\leftrightarrow x \in A$

and so $A \cap (A \cup B) = A$