If A and B are any two sets, their symetric difference is the set $A+B$ defined as follows: $A+B=(A-B)\cup(B-A)$.

If D is a set, then the power set of D is the set P_D of all the subsets of D. That is, $P_D=\{A : A\subseteq D\}$

1. Prove that there is an identity element with respect to the operation +. Let e be the identity element.

$$A+e=A$$
$$(A-e)\cup(e-A)=A$$

As a result there are two cases: $(A-e)=A$ or $(e-A)=A$

$(A-e)=A$ can be interpreted as removing from A all the elements that belong to e to obtain A. It is clear that e must be the $\emptyset$ for this to be true.

Because we determiend that e must be the $\emptyset$, $(e-A)=A$ must not be valid since there is nothing to remove from an empty set.

2. Prove that every subset A of D has an inverse with respect to + Let A^{-1} be the inverse.

$$A+A^{-1}=\emptyset$$
$$(A-A^{-1})\cup(A^{-1}-A)=\emptyset$$

There are two cases: $A-A^{-1}=\emptyset$ or $A^{-1}-A=\emptyset$

$A-A^{-1}=\emptyset$ can be interpreted as removing from A all the elements that belong to A^{-1} to obtain the empty set. It is clear that $A^{-1}=A$.

$A^{-1}-A=\emptyset$ can be interpreted as removing from A^{-1} all the elements that belong to A to obtain the empty set. Thus $A=A^{-1}$