The converse is trivial.

We can prove the direct implication by contradiction.

Let $A \times B = B \times A$ *and* $A \neq B$.

Without loss of generality, we assume $A \not\subset B$

and so there exists $a \in A$ *such that* $a \notin B$.

Let $b \in B$, *then* $(a,b) \in A \times B = B \times A$

and so $a \in B$.

Contradiction.