$$\boxed{X \cap (Y \cup Z) = (Y \cap X) \cup (Z \cap X)}$$

6. To prove $X \cap (Y \cup Z) = (Y \cap X) \cup (Z \cap X)$ we need to prove LHS is $\subseteq$ RHS & vice a versa

lets take an arbitrary element from $X \cap (Y \cup Z)$.
let 'e' be that element $\dashrightarrow$ $e \in X$ & $e \in Y \cup Z \rightarrow (1)$ or

if $e \in Y$ then $e \in Y \cap X$ hence $e \in (Y \cap X) \cup (Z \cap X)$
if $e \in Z$ then $e \in Z \cap X$ hence $e \in (Y \cap X) \cup (Z \cap X)$
(we can say))

since, e was an arbitrary element from $X \cap (Y \cup Z)$ we have shown every element in $X \cap (Y \cup Z)$ is also in $(Y \cap X) \cup (Z \cap X)$. $\boxed{\therefore LHS \subseteq RHS}$ $\rightarrow (2)$

Now, for viceaversa case,
we take arbitrary element ~~e~~ e2 from $(Y \cap X) \cup (Z \cap X)$. which means e2 either belongs to $(Y \cap X)$ or $(Z \cap X)$ like eqn (1)

if $e2 \in Z \cap X$ then e2 belongs to both Y & X
since e2 is in X, It is also in $X \cup (Y \cup Z)$.

$\therefore e2 \in X \cap (Y \cup Z) \rightarrow (3)$

similarly we can say ~~e∈X~~ RHS $\subseteq$ LHS. $\rightarrow (4)$

from (2) & (4) we can conclude that $X \cap (Y \cup Z) = (Y \cap X) \cup (Z \cap X)$ using double inclusion method.