PROOF:

a) Take $f,g\in G$. Then, f and g are bijective. According to Proposition9, $g\circ f$ is also bijective i.e., $g\circ f\in G$. G is closed.

b) According to Proposition8 $\forall f,g,h\in G$, $h\circ\left(g\circ f\right)=\left(h\circ g\right)\circ f$. G is associative.

c) According to Proposition7 $\forall f\in G$, $f\circ I_X=I_X\circ f=f$. Since I_X is bijective, then $I_X\in G$. So, I_X is the identity element of G i.e., G has identity element.

d) According to Proposition12, $\forall f\in G$, $\exists f^{-1}\in G:\ f^{-1}\circ f=f\circ f^{-1}=I_X$ because each function in G is bijective.

Now, we show that G is commutative if and only if $\left|X\right|\le 2$:

"$\Rightarrow$": Assume that $\left|X\right|>2$. Let's show that G is not commutative. Since $\left|X\right|>2$, then G has at least three distinct elements. Let a, b and c denote three distinct elements in G and define the functions $f,g:X\to X$ as follows:

$$f\left(x\right)=\begin{cases}b, & x=a\\ c, & x=b\\ a, & x=c\\ x, & x\in X\setminus\{a,b,c\}\end{cases}\qquad g\left(x\right)=\begin{cases}a, & x=a\\ c, & x=b\\ b, & x=c\\ x, & x\in X\setminus\{a,b,c\}\end{cases}$$

It is obvious that f and g are bijective. So, $f,g\in G$.

Since $\left(g\circ f\right)(b)=g\left(f\left(b\right)\right)=g\left(c\right)=b$ and $\left(f\circ g\right)(b)=f\left(g\left(b\right)\right)=f\left(c\right)=a$, (i.e., $\left(g\circ f\right)(b)\neq\left(f\circ g\right)(b)$) then $g\circ f\neq f\circ g$. Consequently, G is not commutative.

"$\Leftarrow$": Assume that $\left|X\right|\le 2$. Then, $\left|X\right|=1$ or $\left|X\right|=2$.

If $\left|X\right|=1$, then $X=\{a\}$. (Where a is any object) In this case, there is only one function from $\{a\}$ to $\{a\}$. This is I_X being the identity function of X. According to this, $G=\{I_X\}$. Since every group with one element is commutative, then G is also commutative.

If $\left|X\right|=2$, then $X=\{a,b\}$. (Where a and b are objects) There are two bijection from $\{a,b\}$ to $\{a,b\}$. One of them is I_X and the other is the function $f_0=\{(a,b),(b,a)\}$. (I.e., f_0 is the function satisfying $f_0\left(a\right)=b$ and $f_0\left(b\right)=a$) According to this, $G=\{I_X,f_0\}$. Since every group with two elements is commutative, then G is also commutative.