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Theorem 1.1. Yoneda If \mathcal{A} be a locally small category, then,

$$[\mathcal{A}^{op}, Set](H_A, X) \cong X(A) \text{ naturally in } A \in \mathcal{A} \text{ and } X \in [\mathcal{A}^{op}, Set]$$

Explanation:

First of all, we fix any category, \mathcal{A} . Now we choose two things (independent of each other):

- i an object, A from the category $\mathcal{A} = \mathcal{A}^{op}$
- ii an object, X of the category $[\mathcal{A}^{op}, Set]$ which is precisely a functor $X : \mathcal{A}^{op} \rightarrow Set$

Here, $[\mathcal{A}^{op}, Set](H_A, X)$ denotes arrows $H_A \rightarrow X$ in $[\mathcal{A}^{op}, Set]$ i.e. natural transformations, $\alpha : A^{op} \rightarrow Set$

$X(A)$ is precisely a set. As $X(A)$ is the image of (our chosen object,) A , under (our chosen functor,) X .

So, the idea is that our choice of A and X completely determines all possible maps (i.e. natural transformations) from H_A to X . This answers our big question of "what are all the maps $H_A \rightarrow X$ " or "how does H_A see other presheaves on \mathcal{A} ".

More than the above must be true, as it's not just that the two are isomorphic, but they're **naturally** isomorphic. This more is supposed to be that both $[\mathcal{A}^{op}, Set](H_A, X)$ and $X(A)$ are *functorial* in both A and X