Yoneda's Lemma

Let $\mathcal{C}$ be a category, $C \in \mathrm{ob}(\mathcal{C})$ an object. Recall that

$$h_C \colon \mathcal{C}^{\mathrm{op}} \to \mathbf{Set}$$

is the functor; $h_C(-) = \mathrm{Mor}_{\mathcal{C}}(-, C)$.

Lemma (Yoneda's Lemma)

If $F \colon \mathcal{C}^{op} \to \mathbf{Set}$ is a functor, we have a canonical bijection

$$Mor_{Fun(\mathcal{C}^{op},\mathbf{Set})}(h_C, F) \xrightarrow{\sim} F(C).$$

Corollary

As a special case, we have a canonical bijection

$$\mathrm{Mor}_{\mathrm{Fun}(\mathcal{C}^{\mathrm{op}},\mathbf{Set})}(h_C, h_D) \xrightarrow{\sim} \mathrm{Mor}_{\mathcal{C}}(C, D).$$

In words, the corollary says: any natural transformation from h_C to h_D is induced by a morphism from C to D.

Question

Can you formulate Yoneda's lemma involving functors of the form $\mathrm{Mor}(C, -)$?