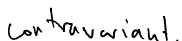
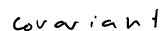


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$$\begin{array}{ccccc} \mathcal{C} & \xrightarrow{\circ p} & \mathcal{C}^{\circ p} & \xrightarrow{G} & \mathcal{D} \\ & & \searrow F & \nearrow & \end{array}$$

where G is covariant,

$$M \longmapsto M^* = \text{Hom}(M, R).$$

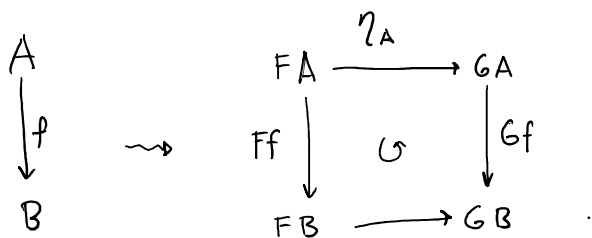
$$(M \xrightarrow{f} N) \longmapsto \left(\begin{array}{ccc} M & \xrightarrow{f} & N \\ \psi \cdot f \downarrow & \xleftarrow{f^*} & \downarrow \psi \\ R & \underline{\quad \quad} & R \end{array} \right)$$

* is faithful & full.

Natural Transformations: $F, G: \mathcal{C} \longrightarrow \mathcal{D}$ covariant functors.

A natural transformation $\eta: F \rightarrow G$ assigns $\eta_A \in \text{Hom}(F(A), G(A))$ to each $A \in \text{ob } \mathcal{C}$.

s. f.

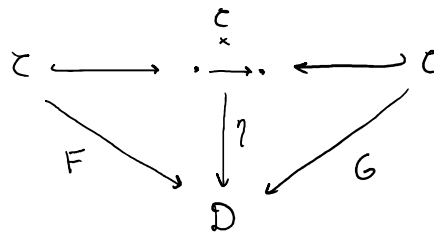


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If η_A is an isomorphism $\forall A$, η is an isomorphism $F \cong G$.

η can be described as a functor $\mathcal{C} \times 2 \longrightarrow \mathcal{D}$ ($2 = (1 \rightarrow 1)$)

s.t.



commutes.