Definition (Opposite category). Given a category $\mathbf{C}$, its *opposite category* $\mathbf{C}^{\mathrm{op}}$ is specified by:

1. *Objects*: $\mathrm{Ob}_{\mathbf{C}^{\mathrm{op}}} = \mathrm{Ob}_{\mathbf{C}}$.

   Given $X \in \mathrm{Ob}_{\mathbf{C}}$, we will sometimes (though not always) write X^{op} to signify when we are thinking of X as an object of $\mathrm{Ob}_{\mathbf{C}}^{\mathrm{op}}$.

2. *Morphisms*: Given objects $X^{\mathrm{op}}, Y^{\mathrm{op}} \in \mathrm{Ob}_{\mathbf{C}^{\mathrm{op}}} = \mathrm{Ob}_{\mathbf{C}}$,

$$\mathrm{Hom}_{\mathbf{C}^{\mathrm{op}}}(X^{\mathrm{op}}, Y^{\mathrm{op}}) := \mathrm{Hom}_{\mathbf{C}}(Y, X).$$

   Given $f \in \mathrm{Hom}_{\mathbf{C}}(Y, X)$, when we are thinking of it as an element of $\mathrm{Hom}_{\mathbf{C}^{\mathrm{op}}}(X^{\mathrm{op}}, Y^{\mathrm{op}})$, we will sometimes write f^{op}.

3. *Identity morphisms*: Given $X^{\mathrm{op}} \in \mathrm{Ob}_{\mathbf{C}^{\mathrm{op}}}$, its identity morphism is

$$\mathrm{Id}_{X^{\mathrm{op}}} := \mathrm{Id}_X^{\mathrm{op}}.$$

4. *Composition*: Let $f^{\mathrm{op}} \in \mathrm{Hom}_{\mathbf{C}^{\mathrm{op}}}(X^{\mathrm{op}}, Y^{\mathrm{op}})$ and $g^{\mathrm{op}} \in \mathrm{Hom}_{\mathbf{C}^{\mathrm{op}}}(Y^{\mathrm{op}}, Z^{\mathrm{op}})$, then

$$f^{\mathrm{op}} \mathbin{\overset{\circ}{_{\circ}}}_{\mathbf{C}^{\mathrm{op}}} g^{\mathrm{op}} := (g \mathbin{\overset{\circ}{_{\circ}}}_{\mathbf{C}} f)^{\mathrm{op}}.$$