Definition. The category $\textbf{Set} \times \textbf{Set}$ has pairs of sets $\langle A, B \rangle$ as its objects, and has pairs of functions $\langle f : A \rightarrow A', g : B \rightarrow B' \rangle$ as its morphisms from $\langle A, B \rangle$ to $\langle A', B' \rangle$. The identity morphism on $\langle A, B \rangle$ is the pair of functions $\langle id_A, id_B \rangle$. The composition $\langle f, g \rangle ; \langle f', g' \rangle$ is the pair of functions $\langle f; f', g; g' \rangle$.

Exercise 1. Show that the function on objects mapping a pair of sets $\langle A, B \rangle$ to the set of pairs $A \times B$ extends to a functor from $\textbf{Set} \times \textbf{Set}$ to $\textbf{Set}$. This functor is often denoted $\textbf{Set} \times \textbf{Set} \rightarrow \textbf{Set}$.

Exercise 2. Show that $\textbf{Set} \times \textbf{Set} \rightarrow \textbf{Set}$ is neither full nor faithful.

Exercise 3. Show that there is a concrete functor (over $\textbf{Set}$) from $\textbf{Set}$ to $\textbf{Rel}(2)$ that is finer than all other such concrete functors.