Exercise 3

This is simple.

$$
\begin{aligned}
& f \circ g = f \circ g' \\
\Rightarrow\ & g \circ f \circ g = g \circ f \circ g' \\
\Rightarrow\ & g \circ 1_B = 1_A \circ g' \\
\Rightarrow\ & g = g'
\end{aligned}
$$

Exercise 9

First, let $e : A \to B$ be an epimorphism in **Pos** and $b \in B$. Let $B' = B \cup \left\{ b' \right\}$ be the poset that is identical to B, except that b is duplicated: We have a b' behaving idential to b in all respects, but $b' \neq b$. Let f be the inclusion from B into B' and f' identical to f except that it maps b to b' instead of b. Both are monotonic functions and therefore morphisms in **Pos**. Since $f \neq f'$ we have, since e was epi that $f \circ e \neq f' \circ e$. This, however means that $b \in e(A)$ because this is the only point where f and f' differ. Since b was chosen arbitrarily we have proven that e is a surjection.

Conversly, if $e : A \to B$ is a surjective morphism then it is epi since this is already true in **Sets** and the forgetful functor is injective.