Proof of $2 \implies 1$.

- Assume that $f \colon A \to B$ is injective.
- Let us write
$$A = \{a_1, a_2, \ldots, a_m\}.$$
- Define $b_k = f(a_k)$ (note that $f(a_k) \in B$ by definition)
- The set
$$\{b_1, b_2, \ldots, b_m\} \subseteq B$$
is size m, since no repeats. This means that $|B| \geq m$.

$\square$