Definition (Properties of a relation)
Consider a relation $R : \mathbf{A} \to \mathbf{B}$. We say that R is:

1. *Injective* if
$$\frac{x\,R\,y \quad z\,R\,y}{x = z};$$
2. *Single-valued* if
$$\frac{x\,R\,y \quad x\,R\,w}{y = w};$$
3. *Surjective* if for all $y \in \mathbf{B}$ there exists an $x \in \mathbf{A}$: $x\,R\,y$;
4. *Everywhere-defined* if for all $x \in \mathbf{A}$ there exists an $y \in \mathbf{B}$: $x\,R\,y$.