Properties of functions

one-to-one or injective function: is a function $f: X \to Y$ where $x_1 \neq x_2$ implies $f(x_1) \neq f(x_2)$

i.e: different elements in X will map to different elements in Y

i.e: no element in Y is mapped upon by two elements in X

onto or surjective function is a function $f: X \to Y$ where the range of f is equal to the target Y

i.e. for every $y \in Y$, there is an $x \in X$ such that $f(x) = y$

i.e. there are no elements in Y that are unmapped

one-to-one correspondence or bijective function or bijection

is a function that is both one-to-one and onto

i.e every element in y is mapped upon by exactly one element in x.

(i.e) no element in y has zero or >1 arrows to it

If the domain and target are finite sets:

relative sizes can be inferred if the equations are one-to-one and/or onto

- if $f: D \to T$ is onto, $|D| \geq |T|$
  - for every element in target, there is at least 1 element in domain (bc all elements in T must be mapped at least once)
- if $f: D \to T$ is one-to-one, $|T| \geq |D|$
  - for every element in domain, there is a unique element in the target (but target can exceed range)
- if $f: D \to T$ is a bijection, $|D| = |T|$