$$f : X \longrightarrow Y$$

domain: X — codomain: Y

Remember to always explicity write out domain and codomain!

totality — existence — uniqueness

$$\forall x \in X,\ \exists! y \in Y,\ y = f(x)$$

for all of the elements in X — there is exactly 1 element of Y — which f assigns to x

In high school likely all the functions you dealt with were from $\mathbb{R} \to \mathbb{R}$. So you might have gotten into the habit of not specifying the domain and codomain. This is bad!!! ∴

$f(x) = x^2$ has completely different properties when $f: \mathbb{N} \to \mathbb{R}$ vs. $f: \mathbb{R} \to \mathbb{R}$ vs $f: \{2\} \to \mathbb{N}$ vs ...

At the very least, forgetting to specify the domain and codomain is just a sad way to lose points