Mathematical Abbreviations For Sets And Maps

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A **function** or **map** from a set X to a set Y is a set of ordered pairs from X and Y (pairs like (x, y) are the coordinates in the graph of the function) satisfying the **uniqueness of image** property:

for all $x \in X$, there exists a **unique** $y \in Y$ that is related to the given x

Then we usually write $y = f(x)$ or just $y = fx$, and $f : X \to Y : x \mapsto f(x)$.

A map $f : X \to Y$ may have any or none of the following properties:

injectivity (1 to 1)	$f(x) = f(y)$ implies $x = y$
surjectivity (onto)	im $f = Y$; denoted $f : X \twoheadrightarrow Y$
bijectivity (both)	injectivity and surjectivity

We shall use sometimes the following common abbreviations:

$\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}, \mathbb{C}$	Natural, integer, rational, real, complex numbers.
$x \in V$	x is a member of set V.
$x \notin V$	x is not a member of set V.
$\exists\, x \in V$	There exists at least one member x in V.
$\forall\, x \in V$	For all members of V.
$W \subseteq V$	W is a subset of set V: so $(\forall\, x \in W)\ x \in V$.
$\{x \in V \mid p(x)\}$	The set of members of V satisfying property p.
$\emptyset$	The empty set.
$f : V \to W$	f is a map or function from V to W.
$f : x \mapsto f(x)$	f sends a typical element x to $f(x)$.
dom f	Domain of f: the set $\{x \mid \exists\, f(x)\}$.
im f	Image of f: the set $\{f(x) \mid x \in \text{dom } f\}$.
fU for $U \subseteq$ dom f	Image of U by f: the set $\{f(x) \mid x \in U\}$.
$f^{\leftarrow}M$ for $M \subseteq$ im f	Inverse image of M by f: the set $\{x \mid f(x) \in M\}$.
1_X	Identity map on x: the map given by $1_X(x) = x$ for all $x \in X$.
$U \cap V$	Intersection of U and V: the set $\{x \mid x \in U \text{ and } x \in V\}$.
$U \cup V$	Union of U and V: the set $\{x \mid x \in U \text{ or } x \in V \text{ or both}\}$.
$V \setminus U$	Complement of U in V: the set $\{x \in V \mid x \notin U\}$.
$f \circ g$	Composite of maps: apply g then f.
$\sum_{i=1}^{n} x_i$	Sum $x_1 + x_2 + \cdots + x_n$.
$\prod_{i=1}^{n} x_i$	Product $x_1 x_2 \cdots x_n$.
$\Rightarrow$	Implies, then.
$\Leftrightarrow$	Implies both ways, if and only if.
$a \times b$	Vector cross product of two vectors.
$a \cdot b$	Scalar product of two vectors.
$\|\|a\|\|$	Norm, $\sqrt{a \cdot a}$, of a vector.