Functions and Relations

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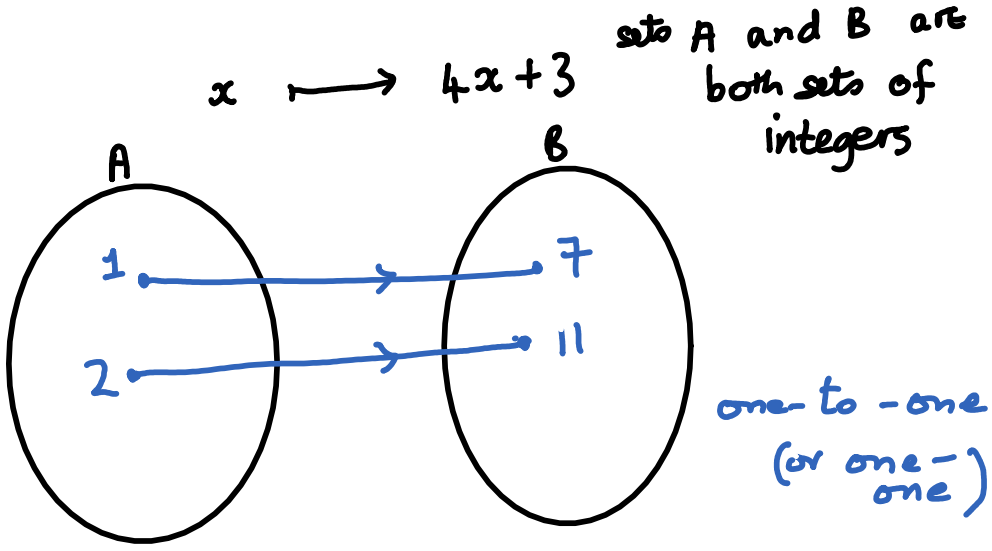
A **cartesian product** $A \times B$
is the set of all ordered pairs (a, b) where $a \in A$ and $b \in B$
Example $A = \{1,2,3\}$ and $B = \{b,c\}$
$A \times B = \{(1, b), (1, c), (2, b), (2, c), (3, b), (3, c)\}$

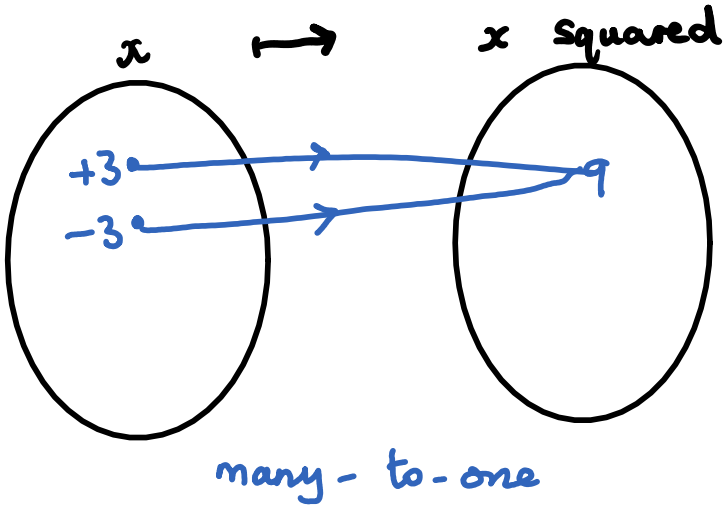
Note $(b,1) \neq (1,b)$
so $A \times B \neq B \times A$

A binary relation links a member of a set A with a set B by some defined rule. We often use ordered 2-tuples to denote these. For example if $a \in A$ and $b \in B$
And a is related to b by a relation R then we can represent it by $(a, b) \in R$ or aRb.

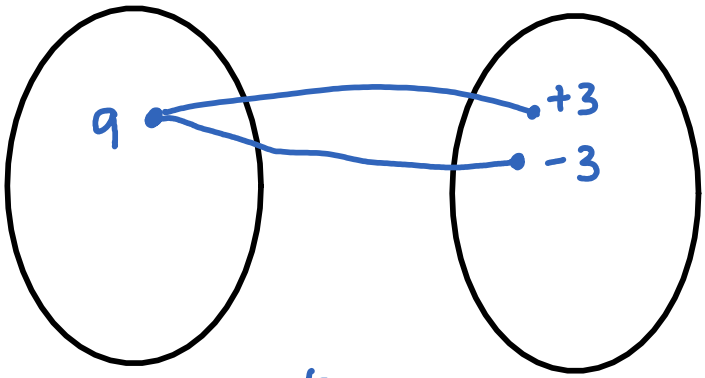
$$R \subseteq A \times B$$

Different types of relations are possible aType equation here.nd we can explore these by using arrow diagrams (sometimes called mappings) and graphs.

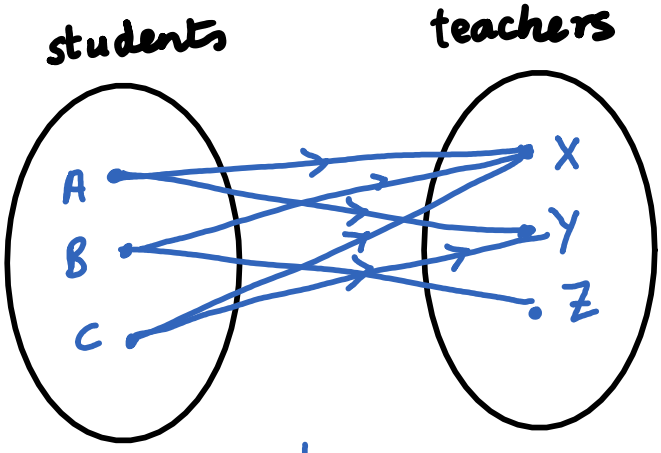




$x \longmapsto$ square root x $(x^{1/2})$



one - to - many



many - to - many

Only one-to-one and many-to-one are functions. Each input has exactly one unique output

So $x \longmapsto 4x+3$ is a function and we can write $f(x) \longmapsto 4x+3$ or $f.x \longmapsto 4x+3$ or $f(x) = 4x+3$

$g(x) \longmapsto x^2$ is also a function

Haskell `f x = x * x` or

`f x = x ^ 2` or `square x = x ^ 2`

λambda expressions – anonymous functions

use `\` for lambda

`\x -> (4 * x + 3)`