

Q Define set.

A collection of well-defined distinct object is called set. It is denoted by capital letters A, B, C etc. For example, $A = \{1,2,3,4\}$

Q: Define union of sets.

The union of two sets A and B , denoted by $A \cup B$ (read as A union B) is the set consisting of all the elements which are either in A or B or in both. Thus

$$A \cup B = \{x | x \in A \text{ or } x \in B \text{ or } x \in A, B \text{ both}\}$$

For example, if $A = \{1,2\}$ and $B = \{1,3\}$, then

$$A \cup B = \{1,2\} \cup \{1,3\}$$

$$A \cup B = \{1,2,3\}$$

Q: Define intersection of two sets. (ALP)

The intersection of two sets A and B , written as $A \cap B$ (read as A intersection B) is the set consisting of all the common elements of A and B . Thus

$$A \cap B = \{x | x \in A \text{ and } x \in B\}$$

For example, if $A = \{1,2\}$ and $B = \{1,3\}$, then

$$A \cap B = \{1,2\} \cap \{1,3\}$$

$$A \cap B = \{1\}$$

Q: Define difference of sets.

The set difference of A and B denoted by $A - B$ (or $A \setminus B$) is the set of all those elements of A but do not belonging to B . Thus

$$A - B = \{x | x \in A \text{ and } x \notin B\}$$

For example, if $A = \{1,2\}$ and $B = \{1,3\}$, then

$$A - B = \{1,2\} - \{1,3\}$$

$$A - B = \{2\}$$

Q: Define complement of a set.

If U is a universal set and A is a subset of U , then the complement of A is the set of those elements of U , which are not contained in A and is denoted by A' or A^c . Therefore

$$A' = U - A$$

$$A' = \{x | x \in U \text{ and } x \notin A\}$$

For example, if $U = \{1,2,3,4,5\}$ and $A = \{1,3\}$, then

$$A' = U - A$$

$$A' = \{1,2,3,4,5\} \cup \{1,3\}$$

$$A' = \{2,4,5\}$$

Q: Define a subset and give one example. (ALP)

A set A is a subset of another set B if all elements of the set A are elements of the set B and it is denoted by $A \subseteq B$. For example if $A = \{1,2\}$ and $B = \{1,2,3\}$, then $A \subseteq B$.

Q: Write DE Morgan law's. (ALP)

For any two sets A and B DE Morgan law's stated as

$$(i) (A \cup B)' = A' \cap B'$$

$$(ii) (A \cap B)' = A' \cup B'$$

Q: Define Venn diagram (closed figures).

British mathematician John Venn (1834-1923) introduced rectangle for a universal set U and its subsets A and B as closed figures inside this rectangle.

Q: Define ordered pair.

An ordered pair of real numbers x and y is a pair (x, y) in which elements are written in specific order.

Q: Define Cartesian product.

Cartesian product of two non-empty sets A and B denoted by $A \times B$ consists of all ordered pairs (x, y) such that $x \in A$ and $y \in B$.

For example, if $A = \{1, 2\}$ and $B = \{2, 3\}$, then

$$A \times B = \{1, 2\} \times \{2, 3\}$$

$$A \times B = \{(1, 2), (1, 3), (2, 2), (2, 3)\}$$

Q: Define binary relation.

If A and B are any two non-empty sets, then a subset $R \subseteq A \times B$ is called binary relation from set A into set B , because there exist some relationship between first and second element of each order pair in R .

Q: Differentiate between domain and range.

If $f: A \rightarrow B$ is a relation, then

Domain f is the set consisting of all first element of each ordered pair in f . *Range f* is the set consisting of all second elements of each ordered pair in f .

Note: if $A = \{1, 2, 3\}$ and $B = \{2, 3\}$, then relation $f: A \rightarrow B$ such that $f = \{(x, y) | x < y\}$

$$A \times B = \{1, 2, 3\} \times \{2, 3\}$$

$$A \times B = \{(1, 2), (1, 3), (2, 2), (2, 3), (3, 2), (3, 3)\}$$

Since $f = \{(x, y) | x < y\}$, so

$$f = \{(1, 2), (1, 3), (2, 3)\}$$

$$\text{Dom } f = \{1, 2\}$$

$$\text{Range } f = \{2, 3\}$$

Q: Define a function. (ALP)

Suppose A and B are two non-empty sets, then relation $f: A \rightarrow B$ is called a function if

(i) $\text{Dom } f = A$

(ii) Every $x \in A$ appears in one and only one ordered pair in f .

Example: Suppose $A = \{0, 1, 2, 3\}$ and $B = \{1, 2, 3, 4, 5\}$, then a function $f: A \rightarrow B$ such that

$$f = \{(x, y) | y = x + 1\}$$

$$A \times B = \{0, 1, 2, 3\} \times \{1, 2, 3, 4, 5\}$$

$$A \times B = \{(0, 1), (0, 2), (0, 3), (0, 4), (0, 5),$$

$$(1, 1), (1, 2), (1, 3), (1, 4), (1, 5),$$

$$(2, 1), (2, 2), (2, 3), (2, 4), (2, 5),$$

$$(3, 1), (3, 2), (3, 3), (3, 4), (3, 5)\}$$

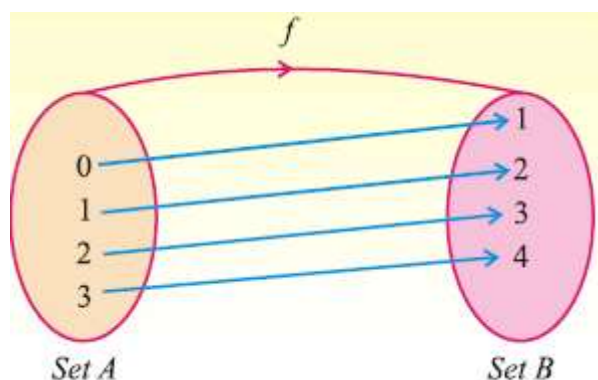
Since $f = \{(x, y) | y = x + 1\}$, so

$$f = \{(0, 1), (1, 2), (2, 3), (3, 4)\}$$

$$\text{Dom } f = \{0, 1, 2, 3\} = A$$

$$\text{Range } f = \{1, 2, 3, 4\} \subseteq B$$

Hence f is a function.

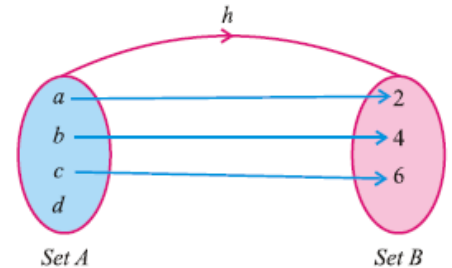
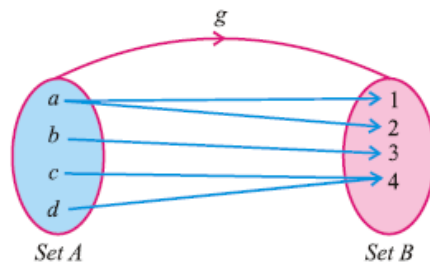


Now let $A = \{a, b, c, d\}$ and $B = \{1, 2, 3, 4\}$ if $g = \{(a, 1), (a, 2), (b, 3), (c, 4), (d, 4)\}$ is a relation, then g is not a function, because an element

$a \in A$ has two images in set B .

Also let $A = \{a, b, c, d\}$ and $B = \{2, 4, 6\}$ if

$h = \{(a, 2), (b, 4), (c, 6)\}$ is a relation, then h is not a function because $\text{Dom } h = \{a, b, c\} \neq A$



Q: What is meant by domain and co-domain of a function.

If $f: A \rightarrow B$ is a function, then A is called the domain of f and B is called co-domain of f .

Q: Define into function. (ALP)

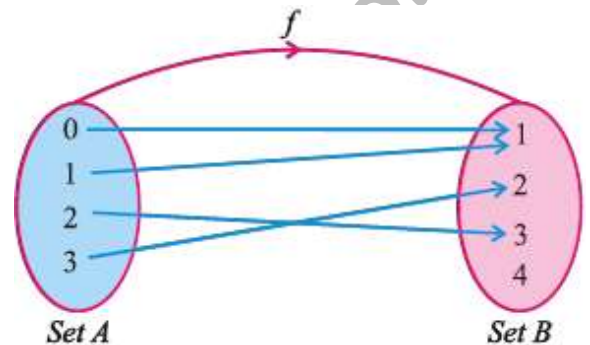
A function $f: A \rightarrow B$, is called an into function, if at least one element in B is not an image of some element of set A . That is $\text{Range } f \subset B$

For example, if $A = \{0, 1, 2, 3\}$ and $B = \{1, 2, 3, 4\}$, let $f = \{(0, 1), (1, 1), (2, 3), (3, 2)\}$ is a function

$$\text{Dom } f = \{0, 1, 2, 3\} = A$$

$$\text{Range } f = \{1, 2, 3\} \subset B$$

Hence, f is an into function.



Q: Define an onto (surjective) function. (ALP)

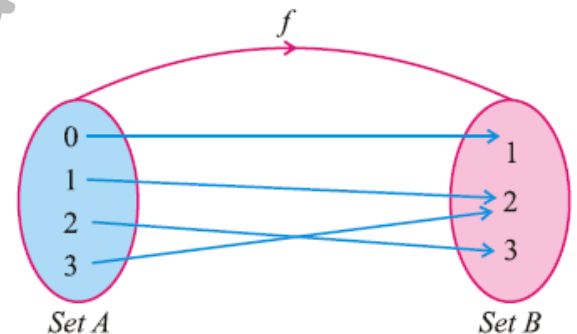
A function $f: A \rightarrow B$, is called onto function, if every element of set B is an image of at least one element of set A . That is $\text{Range } f = B$

For example, if $A = \{0, 1, 2, 3\}$ and $B = \{1, 2, 3\}$, let $f = \{(0, 1), (1, 2), (2, 3), (3, 2)\}$ is a function

$$\text{Dom } f = \{0, 1, 2, 3\} = A$$

$$\text{Range } f = \{1, 2, 3\} = B$$

Hence, f is onto function.



Q: Define one-one function. (ALP)

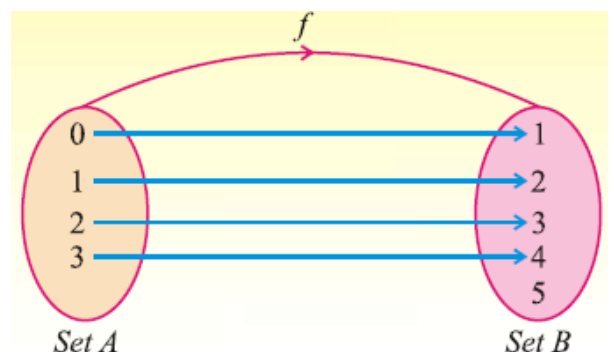
A function $f: A \rightarrow B$, is called one-one function, if all distinct elements of A have distinct images in B . That is $f(x_1) = f(x_2) \Rightarrow x_1 = x_2 \in A$.

For example, if $A = \{0, 1, 2, 3\}$ and $B = \{1, 2, 3, 4, 5\}$, let $f = \{(0, 1), (1, 2), (2, 3), (3, 4)\}$ is a function

$$\text{Dom } f = \{0, 1, 2, 3\} = A$$

$$\text{Range } f = \{1, 2, 3, 4\} \subset B$$

Hence, f is one-one function. It is also into function.



Q: Define bijective function. (ALP)

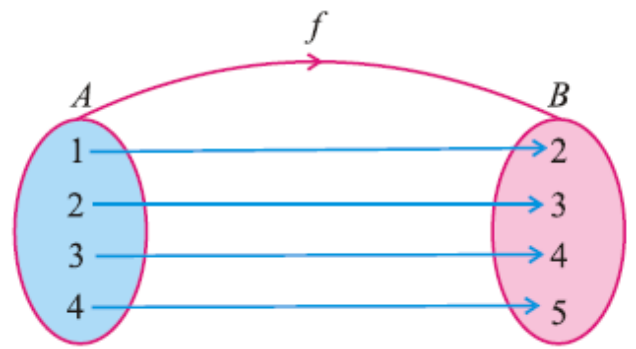
A function $f: A \rightarrow B$, is called bijective function if and only if function f is one-one and onto.

For example, if $A = \{1,2,3,4\}$ and $B = \{2,3,4,5\}$, let $f = \{(1,2), (2,3), (3,4), (4,5)\}$ is a function

$$\text{Dom } f = \{1,2,3,4\} = A$$

$$\text{Range } f = \{2,3,4,5\} = B$$

Hence, f is bijective function.



Q: Define into and one-one (injective) function.

A function $f: A \rightarrow B$, is called into and one-one function if f is into and one-one function.

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