నమస్తే తెలంగాణ
నిపుణ III
Guide to Excellence
పోటీపరీక్షల ప్రత్యేకం
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ఇండియన్ బ్యాంక్ నినాదం ఏమిటి?
ఫాస్ట్ అండ్ ఈజీ

గుడ్ పీపుల్ టు గ్రో విత్ ఏ బ్యాంక్ నినాదం?
ఇండియన్ ఓవర్సీస్ బ్యాంక్

దూరంలోని వస్తువులను మాత్రమే చూడగలిగి, దగ్గరి వస్తువులను చూడలేని స్థితిని ఏమంటారు?
హైపర్ మెట్రోపియా

దగ్గరి వస్తువులను మాత్రమే చూడగలగడాన్ని ఏమంటారు?
మయోపియా

A Set does not Contain any Element is called?

SET THEORY

DEFINITION OF A SET

- A well defined collection of distinct objects is called a **SET.**
- The members of a set are called its ELEMENTS.
- The sets are generally denoted by capital letters A, B, C...., X, Y, Z.
- The elements of a set are generally denoted by small letters a, b, c,....., x, y, z.
- If x is an element of the set A, we write $x \in A$
- If x is not an element of the set A, we write $x \notin A$
- [The symbols $\in$ and $\notin$ and are read as "belongs to" and " does not belong to" respectively]
- A well defined collection is such that given an object, it is possible to determine whether the object belongs to the particular collection or net, for example, the collection of all ministers in the cabinet of the Government of India, the collection of all subject taught to students of class XII, collection of all auto mobile companies which manufacture passengers' car are sets. On the other hand, the collection of all intelligent students in a class, the collection of all tall girls in a senior secondary school, the collection of all difficult questions asked in Mathematics, Physics and Chemistry in IIT-JEE-2005 are not sets, since the words intelligent, tall, difficult are not well defined.

DESCRIPTION OF A SET

- A set may be represented by either of the following two methods :

ROSTER METHOD OR TABULAR FORM

- In this method a set is represented by listing all its elements separated by commas within braces {}

For example

- The set V of vowels in English alphabet is V = {a, e, i, o, u}
- The set E of even natural numbers is E = {2, 4, 6, 8,......}
- The set of letters forming the word SCHOOL is {S, C, H, O, L}
- Note that every element of the set is listed only once and the order in which the elements are listed is immaterial.

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PROPERTY METHOD OR SET BUILDER FORM

- In this method, a, set is represented by stating a rule or a set of rules, which are satisfied by all the elements of the set and not by any other element outside the set. In general, we write S = { x : P (x)}
- Which means that S is a set of elements, which satisfy the condition P(x).
- [The symbol : or | is read as "such that"]

For example

- V = { x : x is a vowel in the English alphabet}
- E = {x : x is an even natural number}
- A = { x : x is a letter of the word SCHOOL}

B = $\{x : 4 \le x \le 7,\ x \in \mathbf{N}\} = \{4, 5, 6, 7\}$
C = {x : x is a factor of 40, x ∈ N} = {1, 2, 4, 5, 8, 10, 20, 40}
D = $\left\{x : x = \frac{n}{n+1}, n \in \mathbf{N} \text{ and } 1 \le n \le 6\right\} = \left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\right\}$

TYPES OF SET

EMPTY SET OR NULL SET OR VOID SET

- A set which does not contain any element is called the empty set.
- A null set is denoted by φ or {}.

For example :

- $A = \{x : x^2 + 1 = 0, x \in \mathbf{R}\}$
- $B = \{x : 1 < x < 2, x \in \mathbf{N}\}$
- C = {x : x is an even prime number greater than 2}
- D = {x : x is a married bachelor}

For example :

- A = {4}
- B = {–7}
- C = {a}
- D = { x : x+4 = 0, x∈I}

$E = \{x : |x| = 7, x \in \mathbf{N}\}$

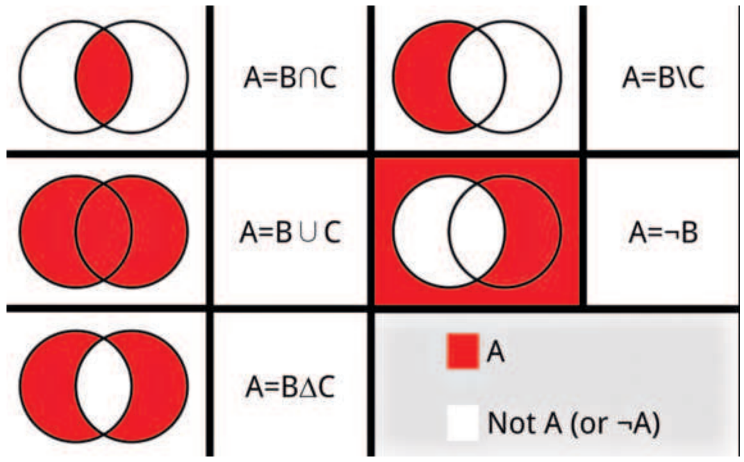
- F = { x : x is the closest planet to the Earth}
- {0} is a singleton set
- φ is a void set but {φ} is a singleton set.

FINITE AND INFINITE SETS

- A set which is empty or consists of a definite number of elements is called **FINITE**. If a set A consists of n distinct elements then we write n (A) = n or O (A) = n It is called the **CARDINAL NUMBER,** or **CARDINALITY** or **ORDER** of the set A. The cardinality of a void set is zero and the cardinality of a singleton set is 1. Other examples of finite set, are
- Set A of days of the week, n (A) = 7
- Set B of solutions of the equation x2– 4 = 0, n (B) = 2
- Set V of vowels in English alphabet, n(V) = 5
- Set M of all men is the world, n (M) may be a quite big number but it is a finite number although we do not know the exact number of elements in M.
- A set whose elements cannot be counted is called an **INFINITE SET.**

For example,

N : the set of natural number = { 1,2,3.........}
Z or I : the set of integers = { ...., –3, –2, –1, 0, 1, 2, 3,....}
Q : the set of rational numbers $= \left\{\frac{p}{q} : p, q \in \mathbf{I}, q \ne 0\right\}$
R : the set of real numbers = { x : x is either a rational number or irrational number}
C : The set of complex numbers $= \{x + iy : x, y \in \mathbf{R}, i = \sqrt{-1}\}$
I^+ : the set of positive integers
Q^+ : the set of positive rational numbers
R^+ : the set of positive real numbers



EQUAL AND EQUIVALENT SETS

- Given two sets A and B. If every element of A is also an element of B and vice versa, the sets A and B are said to be equal and we write A = B. Clearly, A = B, if they have exactly the same elements.

$\therefore A = B, \text{if } x \in A \Rightarrow x \in B \text{ and } x \in B \Rightarrow x \in A$
(The symbol '⇒' stands for 'implies that')

- (The symbol '⇒' stands for 'implies that']

For example :

- Let A ={1, 4, 5} and B = {4, 1, 5}, then A = B
- Let A = { x : 2 x 6, } and B = {2, 3, 4, 5, 6} then A = B
- Let A = { x : x is a prime number number less than 6} and B = {x : x is a prime factor of 30}, then A = B
- Let A = { x : x is a letter of the word ALLOY} and B = {x : x is a letter of the word LOYAL} then A = B
- Let A = {1, 2}, B = {1, 2, 2, 1} and C = { x : x2 – 3x + 2=0} then A = B = C.
- Two finite sets A and B are said to be EQUIVALENT if they have the same number of elements, i.e. n(A) = n(B). We write A≈ B

All equal sets are equivalent but all equivalent sets are not equal.

For example :

- A = {a, b, c} and B = {10, 20, 30} then A ≈ B but A ≠ B
- $A = \{x : 1 \le x \le 3, x \in \mathbf{N}\}$ and $B = \{x : |x| \le 1, x \in \mathbf{I}\}$ then A ≈ B but A ≠ B
- { x : x^2 –16 = 0, } and B = {x : x–16=0, } then A ≈ B as well as A = B.

SUBSETS

- If every element of a set A is also an element of a set B, then A is called a subset of B or A is contained in B and we write A ⊆B. [The symbol ⊆ is read as "a subset of" or "contained in"]
- Thus A ⊆B if x ∈ A ⇒ x ∈ B
- If A ⊆ B, then we also say that B is a SUPERSET of A and we write B⊇A (read as "B contains A").

THEOREMS

∅ ⊂ A i.e. null set is subset of every set
A ⊆ A i.e. every set is subset of itself

For any set A, φ and A are called IMPROPER SUBSETS. All other subsets of A are called PROPER SUBSETS. If B is a proper subset of A, we write . [The symbol is read as " is a proper subset of"]

- For two sets A and B

B $A = B \Leftrightarrow A \subseteq B \text{ and } B \subseteq A$

- [The symbol ⇔ is read as "if and only if" also written as iff or sometimes "implies and implied by"]
- A finite set containing n elements has 2^n subsets. However the number of proper subsets is $2^n – 2$.

Examples :

- If A = {2, 3, 4} and B = {1, 2, 3, 4], then

$A \subseteq B \text{ and } B \nsubseteq A$

- If A = {a, b, c} then n (A) = 3. Hence A has 2^3 = 8 subsets, viz, φ; {a}; {b}; {c}; {a, b}; {b, c}; {c, a}; {a, b, c}. φ and {a,b, c} = A are improper subsets. All other are proper subsets.
- $\mathbf{N} \subset \mathbf{I}, \mathbf{N} \subset \mathbf{Q}, \mathbf{N} \subset \mathbf{R}, \mathbf{N} \subset \mathbf{C}$
- $\mathbf{I} \subset \mathbf{Q}, \mathbf{I} \subset \mathbf{R}, \mathbf{I} \subset \mathbf{C}$
- $\mathbf{Q} \subset \mathbf{R}, \mathbf{Q} \subset \mathbf{C}$
- $\mathbf{R} \subset \mathbf{C}$
- The set of irrational numbers, denoted by T, is composed of all other real numbers. Thus T = {x : x ∈ R and x ∉ Q}, i.e., all real numbers that are not rational. Members of T include $\sqrt{2}$, $\sqrt{5}$ and π.

Some of the obvious relations among these subsets are:
N ⊂ Z ⊂ Q, Q ⊂ R, T ⊂ R, N ⊄ T.

INTERVALS AS SUBSETS OF R

- Let a, b ∈ R and a < b. Then the set of real numbers {y : a < y < b} is called an open interval and is denoted by (a, b). All the points between a and b belong to the open interval (a, b) but a, b themselves do not belong to this interval.
- The interval which contains the end points also is called closed interval and is denoted by [a, b]. Thus [a, b] = {x : a ≤ x ≤ b}.
- We can also have intervals closed at one end and open at the other, i.e.,
- [a, b) = {x : a ≤ x < b} is an open interval from a to b, including a but excluding b.
- (a, b] = {x : a < x ≤ b} is an open interval from a to b including b but excluding a.
- These notations provide an alternative way of designating the subsets of set of real numbers. For example, if A = (–3, 5) and B = [– 7, 9], then A ⊂ B. The set [0, ∞) defines the set of non-negative real numbers, while set (– ∞, 0)

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