Raster form = Tabular form

DATE: / /
PAGE NO.:

Natural Numbers

Q → Irrational number → $\sqrt{2}$, $\sqrt{3}$
R → Real Number → {... −3, −2, −1, 0, 1, 2, 3 ... ∞}
Z (Q) I → Integers → {... −3, −2, −1, 0, 1, 2, 3 ... ∞}
N → Natural number → {1, 2, 3, 4 ... ∞}
W → Whole numbers {0, 1, 2, 3, ...}
C → Complex Numbers → {a + ib} → b: Imaginary No., a: Real No.
$i = \sqrt{-1}$
$i^2 = \sqrt{-1} \times \sqrt{-1} = -1$

Sets

Sets → Roaster form, Builder form

Roaster form
In this form all elements of the set are represented in listing form
Ex → N = {1, 2, 3 ... ∞}

Builder form
In this form all the elements follow rule or property
Ex → {all positive Nos}

Set → Well define collection of Objects.

Ex → set of all whole numbers $0 \le x \le 5$
An → R → {0, 1, 2, 3, 4, 5}
X → $\{x / x \in W,\ 0 \le x \le 5\}$

Ex → Set of cubes of all natural numbers.
An → R = $\{(1)^3, (2)^3, (3)^3, \ldots \infty\}$
X = $\{x / x = (n)^3,\ n \in N\}$

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Ques→ Set of all integers number who
$5 < I > -1$

Ans→ $R = \{ \cancel{0, -2, -3}, 0, 1, 2, 4$

$X = \{ x / x \in I, -1 < x < 5 \}$

Types of Set —

(1) finite set — A set in which no. of elements are countable.

(2) Infinite set – A set in which no. of elements are not countable.

(3) Null Set or Empty set → A set in which no. of element is presented by ϕ or $\{\}$

(4) Singleton set → A set in which a single element is present. Ex = $\{1\}, \{2\}$

(5) Equal Set → $A \subset B$ & $B \subset A$

$A = \{1, 2, 3, 4\}$

$B = \{1, 2, 3, 4\}$

(6) Equivalent Set → No. of elements are same

Ex → $A = \{1, 2, 3, 4, 5\}$

$B = \{a, e, i, o, u\}$

$n(A) = 5$ and $n(B) = 5$

(7) Subset → It is a part of the set.

No. of subset $= 2^{n}$ → n: no. of elements

Ex → $A = \{0, 1, 2\}$

No. of subset $= 2^3 = 8$

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Roaster Method is also known as Tabular form or Enumeration Method.

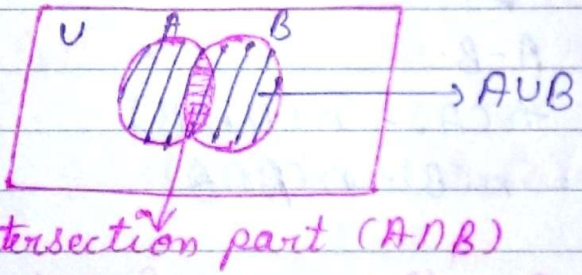
Powerset → Combination of all subsets is called powerset.

Universal set → Collection of elements of the set denoted by U.

Ex → A = {0, 1, 2}
B = {2, 3}
C = {3, 4} ← sets
U = {0, 1, 2, 3, 4}

Cardinal no. of set → no. of elements in the set. ex → A = {-3, -2, 1}
n(A) = 3

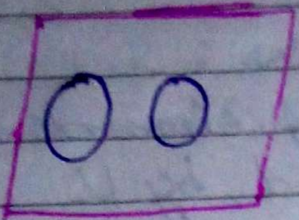
Venn Diagram —



Ex (1) → A = {1, 2, 3}
B = {3, 4, 5, 6}
A∪B = {1, 2, 3, 4, 5, 6}
A∩B = {3}

Ex (2) → If A = {a, b, c, d}
B = {c, d, e, f}
A∪B = {a, b, c, d, e, f}
A∩B = {c, d}

Disjoint Sets —

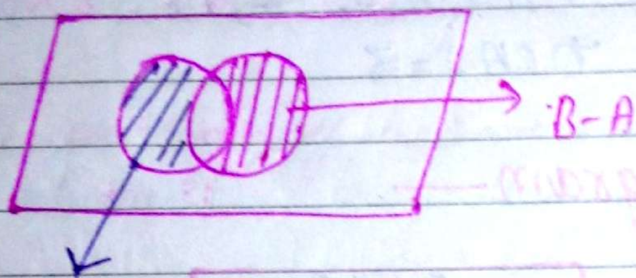


Two sets which have no combination

Difference of two Sets →

A – B → Elements of A which are not present in B.

Through Venn Diagram →



$n(A-B) = n(A) - n(A \cap B)$

$n(B-A) = n(B) - n(B \cap A)$

Symmetric difference of set —

$(A-B) \cup (B-A) = A \Delta B$

Ex → If A is the set of $A = \{2, 3, 4\}$

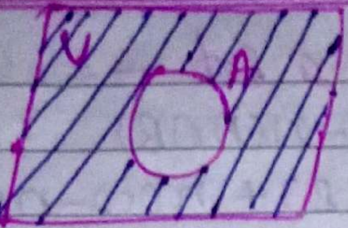
$B = \{3, 4, 5, 6\}$

$A - B = \{2\}$

$B - A = \{5, 6\}$

$(A-B) \cup (B-A) = \{2, 5, 6\} = A \Delta B$

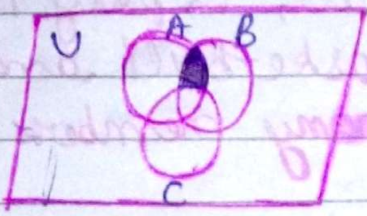
Complement of a Sets →



$U = \{1, 2, 3, 4, 5, 6\}$
$A = \{4, 2, 3\}$
$A' = \{1, 5, 6\}$

A' or A^c is define as complement of A. It means $U - A$.

Ques. The shaded portion of the following venn diagram shows



(1) $A \cap B \cap C$
(2) $A \cap B \cap C'$
(3) $A' \cap B' \cap C$
(4) $A' \cap B' \cap C'$

Laws of Sets —

(1) $A \cup A = A$
(2) $A \cap A = A$ } → Indempotent sets
(3) $A \cup \phi = A$
(4) $A \cap \phi = \phi$ } → Identity law
(5) $A \cup B = B \cup A$
(6) $A \cap B = B \cap A$ } → Commutative law
(7) $A \cup (B \cup C) = (A \cup B) \cup C$
(8) $A \cap (B \cap C) = (A \cap B) \cap C$ } → Associative law
(9) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
(10) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ } → Distributive law
(11) $(A \cup B)' = A' \cap B'$
(12) $(A \cap B)' = A' \cup B'$ } Demorgan's law

★ No. of elements of a set —

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C)$
$- n(C \cap A) + n(A \cap B \cap C)$

Ques — Of the members of a 3 athletic teams in a school, 21 are in the basketball team, 26 in hockey team and 29 in football team, 14 play hockey and basketball, 15 play hockey & football, 12 play football & basketball and 8 play all the 3 games. How many members are there in all?

Ans → According to question —

$n(B) = 21$, $n(H) = 26$, $n(F) = 29$.

$n(B \cap H) = 14$, $n(H \cap F) = 15$, $n(F \cap B) = 12$.

$n(B \cap H \cap F) = 8$

$n(B \cup H \cup F) = ?$

$n(B \cup H \cup F) = n(B) + n(H) + n(F) - n(B \cap H) - n(H \cap F) -$
$n(F \cap B) - n(B \cap H \cap C)$

$\Rightarrow 21 + 26 + 29 - 14 - 15 - 12 + 8$

$= 76 - 14 - 15 - 4$

$= 76 - 29 - 4$

$= 76 - 33$

$= 43$

Ques — Out of 20 members in a family 11 like to take tea and 14 like to take coffee. Assume that each member like at least one of the two drinks. How many like —

(i) Both tea & coffee

(ii) Only tea not coffee

(iii) Only coffee not tea

(i) $n(T \cup C) = 20,\ n(T) = 11,\ n(C) = 14$

$n(T \cup C) = n(T) + n(C) - n(T \cap C)$

$20 = 11 + 14 - n(T \cap C)$

$n(T \cap C) = 11 + 14 - 20$

$n(T \cap C) = 25 - 20$

$n(T \cap C) = 5$

(ii) $n(T - C) = n(T) - n(T \cap C)$

$= 11 - 5 = 6$

ll, (iii) $n(C - T) = n(C) - n(T \cap C)$

$= 14 - 5$

$= 9$

Ques. There are 210 members in a club 100 of them take tea but 65 take tea but not coffee each member takes tea or coffee (i) How many take coffee (ii) How many take coffee not tea.

Sol → Acc. to question—

$n(T \cup C) = 210,\ n(T) = 100,\ n(T - C) = 65$

(i) ~~nTAB~~ $n(T \cap C) = ?$

$n(T \cup C) = n(T) + n(C) - n(T \cap C)$

$210 = 100 + n(C) - n(T \cap C)$ —(1)

$n(T - C) = n(T) - n(T \cap C)$

$65 = 100 - n(T \cap C)$

$n(T \cap C) = 35$

from (1) → $210 - 100 = n(C) - 35$

$n(C) = 110 + 35$

$n(C) = 145$

(2) $n(C - T) = n(C) - n(T \cap C)$

$n(C - T) = 145 - 35$

$n(C - T) = 110$

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PAGE NO.

Ques. Let A and B two sets and U is the universal set such that $n(U) = 700$, $n(A) = 200$, $n(B) = 300$, $n(A \cap B) = 100$, $n(A' \cap$

Ans → Acc. to question,

$$n(A') = n(U) - n(A)$$
$$= 700 - 200$$
$$= 500$$
$$n(B') = n(U) - n(B)$$
$$= 700 - 300$$
$$= 400$$
$$n(A' \cap B') = n(A \cup B)'$$
$$n(A' \cap B') = 300$$

Ques. In a group of 1000 persons 750 who can speak hindi and 400 who can speak english. How many speak hindi only, How many can speak english only and how many can speak both.

Sol →

$$n(A \cup B) = 1000$$
$$n(A) = 750$$
$$n(B) = 400$$
$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$1000 = 750 + 400 - n(A \cap B)$$
$$1000 = 1150 - n(A \cap B)$$
$$n(A \cap B) = 1150 - 1000$$
$$n(A \cap B) = 150$$
$$n(A - B) = n(A) - n(A \cap B)$$
$$= 750 - 150$$
$$= 600$$
$$n(B - A) = n(B) - n(A \cap B)$$
$$= 400 - 150$$
$$= \cancel{200}50$$

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DATE: / /
PAGE NO.:

29/7/16

Questions —

(1) A set of real no. is the union of the set of —
(a) Rational no. & Irrational no.
(b) Rational no. & Integers no.
(c) Natural no. & Rational no.
(d) Natural no. & Whole no.

(2) Which of the following is false for the set A & B.
(i) $A \cup B = B \cup A$ (ii) $A \cup A = A$
(iii) $A \cap B = B \cap A$ (iv) None of the above

(3) The symmetric diff. of the sets A & B is.
(i) $(A \cap B) - (A \cup B)$ (iii) $A \cup B - A \cap B$
(ii) $A - B \cap B - A$ (iv) None of the above

(4) The set of irrational no. is —
(i) finite set (iii) Infinite set
(ii) Countably (iv) Uncountably infinite set

(5) The symbol 'Q' stands for the set of
(i) Natural No. (iii) Irrational no.
(ii) Integer No. (iv) None of the above

(6) $\sqrt{7}$ is a —
(i) Integer no. (iii) Irrational No.
(ii) whole no. (iv) Natural No.

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