8) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

Sol^n let (x, y) be any element of $A \times (B \cap C)$

Then $(x, y) \in A \times (B \cap C)$

$x \in A$ & $y \in (B \cap C)$

$x \in A$; and $(y \in B)$ and $(y \in C)$

$(x \in A$ and $y \in B)$ and $((x \in A)$ and $(y \in C))$

$(x, y) \in A \times B$ and $(x, y) \in A \times C$

$(x, y) \in (A \times B) \cap (A \cap C)$

So, $A \times (B \cap C) \subseteq (A \times B) \cap (A \times C)$ — ①

Now, $(x, y) \in (A \times B) \cap (A \times C)$

$\rightarrow$ $(x, y) \in A \times B$ and $(x, y) \in A \times C$

$(x \in A$ and $y \in B)$ & $(x \in A$ and $y \in C)$

$x \in A$ and $(y \in B$ and $y \in C)$

$x \in A$ and $y \in (B \cap C)$

~~$x \in A$ and~~

$(x, y) \in A \times (B \cap C)$

$\therefore (A \times B) \cap (A \times C) \subseteq A \times (B \cap C)$ — (ii)

from (i) & (ii) we get the same.

CLASS OF SETS :

(c) Sets of sets or collection of sets.
→ (Subclass or subcollection)

$S = \{1, 2, 3, 4\}$. Let let be the class of subsets of S

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

Let B be the class of subsets of S which contains

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

∴ B is subclass of A since every element of B is also in A.

PARTITIONS OF SETS :-

Let S be a non-empty set. A partition of S is a subdivision of S into non-overlapping, non-empty subsets.

Precisely a partition of S is a collection of $\{A_i\}$ non-empty subsets of S such that:

(i) Each a in S belongs one of A_i

(ii) sets of $\{A_i\}$ are mutually disjoint

$A_i \neq A_j$ then $A_i \cap A_j = \phi$.

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

Sol^n Let $x \in A \cap (B \cup C)$

$\Rightarrow x \in A$ and $\underbrace{x \in (B \cup C)}$

$\Rightarrow x \in A$ and $(x \in B$ or $x \in C)$

$\Rightarrow (x \in A$ and $x \in B)$ or $(x \in A$ and $x \in C)$

$\Rightarrow [x \in (A \cap B)] \cup [(x \in (A \cap C))]$

$\Rightarrow \therefore x \in [(A \cap B) \cup (A \cap C)]$.

$\therefore \quad A \cap (B \cup C) \subseteq (A \cap B) \cup (A \cap C)$. — (i)

Again $x \in (A \cap B) \cup (A \cap C)$.

$\Rightarrow (x \in A$ and $x \in B)$ or $(x \in A$ and $x \in$

$\Rightarrow x \in A$ and $(x \in B$ or $x \in C)$

$\Rightarrow x \in A \cap (B \cup C)$

$\Rightarrow (A \cap B) \cup (A \cap C) \subseteq A \cap (B \cup C)$ — (2)

from (1) & (2).

$(A \cap B)^c = A^c \cup B^c$.

Let $x \in (A \cap B)^c$

$\Rightarrow x \notin (A \cap B)$

$\Rightarrow x \notin A$ and $x \notin B$.

$\Rightarrow x \in A^c$ or $x \in B^c$.

$\Rightarrow x \in (A^c$ or $B^c)$

$\Rightarrow x \in (A^c \cup B^c)$

$(A \cap B)^c \subseteq A^c \cup B^c$. — (1).

Let $x \in (A^c \cup B^c)$

$\Rightarrow x \in A^c$ or $x \in B^c$

$\Rightarrow x \notin A$ and $x \notin B$

$\Rightarrow x \notin (A \cap B)$

$\Rightarrow x \in (A \cap B)^c$

$\Rightarrow A^c \cup B^c \subseteq (A \cap B)^c$ — (2)

from (1) & (2) LHS = RHS.

---

(2) If $A \subset B$ show $B' \subset A'$.

Sol^n) Let $x \in B'$

$\Rightarrow x \notin B$.

Also $x \notin A$ (as $B \subset A$)

$\Rightarrow x \in A^c$.

$\therefore$ $B^c \subset A^c$.

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

Sol^n Let $x \in (A-B) \cup (B-A)$

$\Rightarrow x \in (A-B)$ or $x \in (B-A)$

$\Rightarrow$ ($x \in A$ and $x \notin B$) or ($x \in B$ and $x \notin A$)

$\Rightarrow$ ($x \in A$ ~~and~~ or $x \in B$) and ($x \notin B$ and $x \notin A$)

$\Rightarrow [x \in (A\cup B)]$ and $[x \notin (B\cap A)]$

$\Rightarrow x \in (A\cup B) - x \notin (B\cap A)$

$\Rightarrow x \in (A\cup B - (B\cap A)]$.

$\Rightarrow x \in (A\cup B) - (B\cap A)$

Again $x \in (A\cup B)$ and $x \notin (B\cap A)$

$\Rightarrow x \in (A\cup B)$ and ($x \notin B$ and $x \notin A$)

$\Rightarrow$ ($x \in A$ or $x \in B$) and ($x \in B'$ or $x \in A'$)

$\Rightarrow$ ($x \in A$ or $x \in B$) and (

$\Rightarrow$ ($x \in A$

Date

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4 In a city 45% ppl read magazine A, 55% read magazine B and 40% read mag. C 30% read A and B, 15% read B and C, 25% read C and A, and 10% read all the magazines. Find :-

(i) what % reads exactly one type of mag.?

(ii) " only two types of " ?

(iii) " atleast 2 types of magazines.

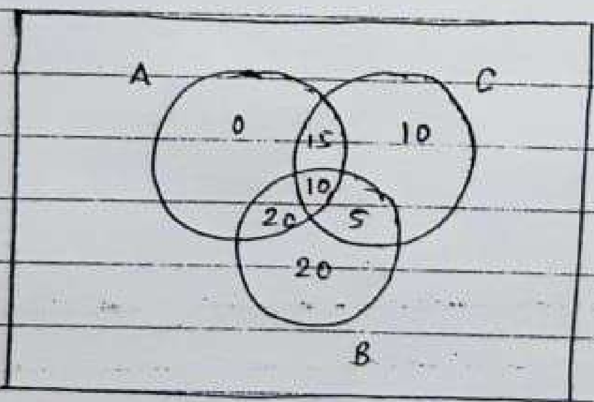
(iv) " doesn't read mag. at all?

(v) " atmost 2 magazines? (consider one type case also)

$n(A) = 45$, $n(B) = 55$, $n(C) = 40$

$n(A \cap B) = 30$, $n(B \cap C) = 15$, $n(C \cap A) = 25$

$n(A \cap B \cap C) = 10$.



(i) exactly one type $= 0 + 20 + 10 = \underline{30\%}$

(ii) only 2 $= 20 + 15 + 5 = \underline{40\%}$

(iii) atleast two $= (40) + 10 = \underline{50\%}$

(iv) no magazines $= 100 - ((0+10+20) + (20+15+5) + 10)$
$= \underline{20\%}$

9) $S = \{1, 2 \cdots 9\}$

(i) $\{\{1, 3, 5\}, \{2, 6\}, \{4, 8, 9\}\}$

No, becoz $7 \in S$ but not in any subsets.

(ii) $\{\{1, 3, 5\}, \{2, 4, 6, 8\}, \{5, 7, 9\}\}$. No

(iii) $\{\{1, 3, 5\}, \{2, 4, 6, 8\}, \{7, 9\}\}$. Yes.

9) If $A \subseteq B$, $C \subseteq D$.

T.P $A \times C \subseteq B \times D$.

Soln

$(x, y) \in (A \times C)$

$(x \in A) \wedge y \in C$.

$x \in B \wedge y \in D$.

$(x, y) \in B \times D$.

$(A \times C) \subseteq B \times D$.

Principle of Inclusion & Exclusion:-

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

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

Addition formula:-

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

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

Q) $(A-B) \cup (B-A) = (A \cup B) - (B \cap A)$

Sol^n let x be arbitrary element of $(A-B) \cup (B-A)$

$x \in (A-B) \cup (B-A) \Rightarrow x \in (A-B)$ or $x \in (B-A)$

$\Rightarrow ((x \in A)$ and $x \notin B)$ or $(x \in B$ and $x \notin A)$

$\Rightarrow (x \in A$ or $x \in B)$ and $(x \notin B$ and $x \notin A)$

$\Rightarrow ([x \in (A \cup B)]$ and $[x \notin (B \cap A)])$

$[x \in (A \cup B)] - [x \in (B \cap A)]$

$x \in [(A \cup B) - (B \cap A)]$

Now, let x ie arbitrary element of $[(A \cup B) - (A \cap B)]$

$\therefore x \in [(A \cup B) - (A \cap B)]$

$\Rightarrow x \in (A \cup B)$ and $x \in (A \cap B)$

$\Rightarrow x \in (A \cup B)$ and $x \in (A \cap B)'$

$\cancel{(x \in (A \cup B)}[(x \in A)$ or $(x \in B)]$ and $[x \in B$ and $\{(x \in A')$ or $(x \in B')]$

Proving Ques on sets:-

Q1) $(A')' = A$.

Let x be an arbitrary element of $(A')'$

$\therefore x \in (A')'$

$\Rightarrow x \notin A'$

$\Rightarrow x \in A$.

$\therefore (A')' \subseteq A$. — (1)

Now let $x \in A$.

then $x \notin A'$,

$x \in (A')'$.

So, $A \subseteq (A')'$ — (2)

from (1) & (2). we can say.

LHS = RHS.

(i) Let $x \in$ LHS.

get $x \in$ RHS.

$\therefore$ LHS $\subseteq$ RHS.

(ii) then let $x \in$ RHS

get $x \in$ LHS

$\therefore$ RHS $\subseteq$ L

$\therefore$ LHS = RHS.

Q2). Prove Commutative Law:-

$A \cap B = B \cap A$.

Sol^n) Let $x \in (A \cap B)$

$\Rightarrow x \in A$ and $x \in B$.

$\Rightarrow x \in B$ and $x \in A$

$\Rightarrow x \in (B \cap A)$. — (1).

$\therefore A \cap B \subseteq B \cap A$.

Again, $x \in (B \cap A)$

$\Rightarrow x \in B$ and $x \in A$

$\Rightarrow x \in A$ and $x \in B$.

$\Rightarrow x \in (A \cap B)$

$\Rightarrow \therefore B \cap A$

from (1) &

LHS = R