Welland Gouldsmith School, Patuli

Class - XI
Subject – Mathematics
Topic – Set Theory
Worksheet Answer : 1

1. i) Let A = {5, 25, 125, 625}
Ans. : $\{x : x = 5^n, n \in N \text{ and } n \leq 4\}$

ii) Let A = $\{1/2, 2/3, 3/4, 4/5 \ldots\ldots\}$
Ans. : $\{x : x = \frac{n}{n+1}, x \in N\}$

iii) A = {-1, 0, 2}
P(A) = {φ, {-1}, {0}, {2}, {-1, 0}, {0, 2}, {-1, 2}, {-1, 0, 2}}

iv) U = {1, 2, 3 .....40}
A = { x : x is a factor of 42}
∴ A = {1, 2, 3, 6, 7, 14, 21}
∴ n(A) = 7

v) A = {4, 6, 8}
subsets of A are {φ}, {4}, {6}, {8}, {4, 6}, {6, 8}, {4, 8}, {4, 6, 8}

2. A = {1, 2, 3, 4}, B = {2, 4, 6, 8, 10}, S = (1, 2, 3, ...10}

$A \cup B = \{ x : x \in A \vee x \in B\} = \{1, 2, 3, 4, 6, 8, 10\}$
$A \cap B = \{x : x \in A \wedge x \in B\} = \{2, 4\}$
$\therefore (A \cup B)' = \{x : x \in S \wedge x \notin (A \cup B)\}$
$= \{5, 7, 9\}$
$(A \cap B)' = \{ x : x \in S \wedge x \notin (A \cap B)\}$
$= \{1, 3, 5, 6, 7, 8, 9, 10\}$

3. A = {1, 3}, B = {3, 5}, C = {5, 10}
A X B = {(1, 3), (1, 5), (3, 3), (3, 5)}
B X A = {(3, 1), (3, 3), (5, 1), (5, 3)}
∴ A X B ≠ B X A
Again B ∪ C = {3, 5, 10}
A X (B ∪ C) = {(1, 3), (1, 5), (1, 10), (3, 3), (3, 5), (3, 10)}
A X C = {(1, 5), (1, 10), (3, 5), (3, 10)}

$(A \times B) \cup (A \times C) = \{(1, 3), (1, 5), (3, 3), (3, 5), (1, 10), (3, 10)\}$ verified

Again $(B \cap C) = \{5\}$

$\therefore A \times (B \cap C) = \{(1, 5), (3, 5)\}$

$\therefore (A \times B) \cap (A \times C) = \{(1, 5), (3, 5)\}$ verified

4. $A = \{2, 3, 5, 7, 8\}$, $B = \{1, 5, 9\}$, $A' = \{1, 4, 6, 9\}$

$U = A \cup A' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

i) $\therefore (A \cup B) = \{ x : x \in A \vee x \in B\} = \{1, 2, 3, 5, 7, 8, 9\}$

$(A \cup B)' = \cup - (A \cup B) = \{4, 6\}$

$A' = U - A = \{1, 4, 6, 9\}$

$B' = U - B = \{2, 3, 4, 6, 7, 8\}$

$A' \cap B' = \{4, 6\}$ [verified]

ii) $B - A = \{x : x \in B \wedge x \notin A\} = \{1, 9\}$

$A' \cap B = \{1, 9\}$ [verified]

5. $n (U) = 30$, $n(A') = 15$, $n (B) = 5$, $n (A \cap B) = 3$

$n(A) = n (U) - n (A') = 30 - 15 = 15$

$n (A \cup B) = n (A) + n (B) - n (A \cap B) = 15 + 5 - 3 = 17$

$n (A - B) = n (A \cup B) - n (B) = 17 - 5 = 12$

6. $n (U) = 60$, $n (A) = 35$, $n (A \cap B) = 15$

$n ((A \cup B)') = 20$

$n (A \cup B) = n (U) - n ((A \cup B)') = 60 - 20 = 40$

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

$40 = 35 + n (B) - 15$

$n (B) = 40 - 35 + 15 = 20$

$n (B - A) = n (B) - n (A \cap B) = 20 - 15 = 5$

7. L.H.S. $= A - (B \cup C)$

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

$= A \cap (B' \cap C')$ [by De Moraines Law]

$= (A \cap A) \cap (B' \cap C')$ [by Idempotent Law]

$= A \cap [A \cap (B' \cap C')]$ [by Associative Law]

$= A \cap [(A \cap B') \cap C']$ [by Associative Law]

$= A \cap [C' \cap (A \cap B')]$ [by Commutative Law]

$= (A \cap C') \cap (A \cap B')$ [by Associative Law]

$= (A \cap B') \cap (A \cap C')$ [by Commutative Law)

$= (A - B) \cap (A - C)$ [verified]

8. Here $B \subseteq A$

$\therefore x \in B \Rightarrow x \in A$

Let $B - A \neq \varphi$

$\therefore$ There is atleast one element

x in B – A

Now $x \in B - A$

$x \in B \wedge x \notin A$

$\therefore x \in A \wedge x \notin A$ [$x \in B \Rightarrow x \in A$]

$\therefore x \in A \wedge x \notin A$ cannot be true.

$\therefore B - A \neq \varphi$ is wrong.

$\therefore B - A = \varphi$ [verified]

9. Let A be the sets of people who can speak English, B be the sets of people who can speak Hindi, C be the sets of people who can speak Bengali.

$\therefore n(A) = 31, n(B) = 36, n(C) = 27$

$n(A \cap B) = 10, n(C \cap A) = 9, n(B \cap C) = 11$

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

$\therefore n(A \cup B \cup C) = 31 + 36 + 27 - 10 - 9 - 11 + n(A \cap B \cap C)$

$= 64 + n(A \cap B \cap C)$

The value of $n(A \cup B \cup C)$ will be least if $n(A \cap B \cap C) = 0$

$\therefore$ The Least number of people = 64

And n (A ∪ B ∪ C) will be maximum if n (A C B ∩ C) is maximum

$\therefore$ max of $n(A \cap B \cap C)$=Minimum of $n(A \cap B)$, $n(B \cap C)$, $n(C \cap A)$

$\therefore$ Minimum number is = 9

$\therefore$ The greatest no. of people in the group = 64 + 9 = 73.

10. Let X no. of people read newspaper A.

Y no. of people read newspaper B

$\therefore n(X) = 50, n(Y) = 20, n(X \cap Y) = 10$

$\therefore n(XU Y) = n(X) + n(Y) - n(X \cap Y)$

$= 50 + 20 - 10 = 60$

11. Let A no. of students eat burger
B no. of students eat noodles.
$n(A) = 50, n(B) = 42, n(A \cap B) = 24$
$\therefore n(A \cup B) = 50 + 42 - 24 = 68$

i) No. of students eat only burger
$= n(A) - n(A \cap B)$
$= 50 - 24 = 26$

ii) No. of students eat only noodles
$= n(B) - n(A \cap B)$
$= 42 - 24 = 18$

iii) No. of students who eat any of the two food items = 68.

12. Let A is no. of students drink tea
B no. of students drink milk
$\therefore n(A) = 150,\ n(B) = 225,\ n(A \cap B) = 100$

$\therefore n(A \cup B) = n(A) + n(B) - n(A \cap B)$
$= 150 + 225 - 100$
$= 275$

$\therefore$ no. of students who were drinking neither tea or milk
$= 600 - 275$
$= 325.$