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Answers Key:

5 Marks

1. (i) X = {1, 3, 5} Y = {1, 2, 3}
X = {1, 3, 5} Y = {1, 2, 3}
X∪ Y= {1, 2, 3, 5}
(ii) A = [a, e, i, o, u} B = {a, b, c}
A = {a, e, i, o, u} B = {a, b, c}
A∪ B = {a, b, c, e, i, o, u}
(iii) A = {x : x is a natural number and multiple of 3} B = {x : x is a natural number less than 6}
A = {x: x is a natural number and multiple of 3} = {3, 6, 9 ...}
As B = {x: x is a natural number less than 6} = {1, 2, 3, 4, 5, 6}
A ∪ B = {1, 2, 4, 5, 3, 6, 9, 12 ...}
∴ A ∪ B = {x: x = 1, 2, 4, 5 or a multiple of 3}
(iv) A = {x : x is a natural number and $1 < x \leq 6$ } B = {x : x is a natural number and $6 < x < 10$ }
A = {x : x is a natural number and $1 < x \leq 6$} = {2, 3, 4, 5, 6}
B = {x : x is a natural number and $6 < x < 10$} = {7, 8, 9}
A∪ B = {2, 3, 4, 5, 6, 7, 8, 9}
∴ A∪ B = {x: $x \in N$ and $1 < x < 10$}
(v) A = {1, 2, 3}, B = ϕ
A = {1, 2, 3}, B = Φ A∪ B = {1, 2, 3}
2. (i) A ∪ B
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
A ∪ B = {1, 2, 3, 4, 5, 6}
(ii) A ∪ C
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
A ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}
(iii) B ∪ C
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
B ∪ C = {3, 4, 5, 6, 7, 8}
(iv) B ∪ D
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
B ∪ D = {3, 4, 5, 6, 7, 8, 9, 10}
(v) A ∪ B ∪ C
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
A ∪ B ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}
(vi) A ∪ B ∪ D
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
A ∪ B ∪ D = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
(vii) B ∪ C ∪ D
A = {1, 2, 3, 4], B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}
B ∪ C ∪ D = {3, 4, 5, 6, 7, 8, 9, 10}
3. (i) A ∩ B
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}
C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
A ∩B = {x: x is a even natural number} = B
(ii) A ∩ C
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}
C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
A ∩ C = {x: x is an odd natural number} = C
(iii) A ∩ D
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}
C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
A ∩ D = {x: x is a prime number} = D
(iv) B ∩ C
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}

C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
B ∩ C = Φ
(v) B ∩ D
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}
C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
B ∩ D = {2}
(vi) C ∩ D
A = {x: x is a natural number} = {1, 2, 3, 4, 5 ...}
B ={x: x is an even natural number} = {2, 4, 6, 8 ...}
C = {x: x is an odd natural number} = {1, 3, 5, 7, 9 ...}
D = {x: x is a prime number} = {2, 3, 5, 7 ...}
C ∩ D = {x: x is odd prime number}

4. (i) A − B
A − B = {3, 6, 9, 15, 18, 21}
(ii) A − C
A − C = {3, 9, 15, 18, 21}
(iii) A − D
A − D = {3, 6, 9, 12, 18, 21}
(iv) B − A
D − A = {5, 10, 20}
(v) C − A
C − A = {2, 4, 8, 10, 14, 16}
(vi) D − A
D − A = {5, 10, 20}
(vii) B − C
B − C = {20}
(viii) B − D
B − D = {4, 8, 12, 16}
(ix) C − B
C − B = {2, 6, 10, 14}
(x) D − B
D − B = {5, 10, 15}
(xi) C − D
C − D = {2, 4, 6, 8, 12, 14, 16}
(xii) D − C
D − C = {5, 15, 20}

5. To show: A = (A ∩ B) ∪ (A − B)
Let x ∈ A
We have to show that x ∈ (A ∩ B) ∪ (A − B)
Case I
x ∈ A ∩ B
Then, x ∈ (A ∩ B) ⊂ (A ∪ B) ∪ (A − B)
Case II
x ∉ A ∩ B
⇒ x ∉ A or x ∉ B
∴ x ∉ B [x ∉ A]
∴ x ∉ A − B ⊂ (A ∪ B) ∪ (A − B)
∴ A ⊂ (A ∩ B) ∪ (A − B) ... (1)
It is clear that
A ∩ B ⊂ A and (A − B) ⊂ A
∴ (A ∩ B) ∪ (A − B) ⊂ A ... (2)
From (1) and (2), we obtain
A = (A ∩ B) ∪ (A − B)
To prove: A ∪ (B − A) ⊂ A ∪ B
Let x ∈ A ∪ (B − A)
⇒ x ∈ A or x ∈ (B − A)
⇒ x ∈ A or (x ∈ B and x ∉ A)
⇒ (x ∈ A or x ∈ B) and (x ∈ A or x ∉ A)
⇒ x ∈ (A ∪ B)
∴ A ∪ (B − A) ⊂ (A ∪ B) ... (3)
Next, we show that (A ∪ B) ⊂ A ∪ (B − A).
Let y ∈ A ∪ B
⇒ y ∈ A or y ∈ B
⇒ (y ∈ A or y ∈ B) and (y ∈ A or y ∉ A)

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

$\Rightarrow y \in A \cup (B - A)$

$\therefore A \cup B \subset A \cup (B - A)$ ... (4)

Hence, from (3) and (4), we obtain $A \cup (B - A) = A \cup B$.

2 Marks

6. The given equation can be written as

   $(x - 1)(x + 2) = 0$, i. e., $x = 1, -2$

   Therefore, the solution set of the given equation can be written in roster form as $\{1, -2\}$.

7. We may write the set A as

   A = {x : x is the square of a natural number}

   Alternatively, we can write A = {x : x = n2, where $n \in N$}

8. We see that each member in the given set has the numerator one less than the denominator. Also, the numerator begin from 1 and do not exceed 6. Hence, in the set-builder form the given set is

   $\left\{x : x = \frac{n}{n+1},\ \text{where } n \text{ is a natural number and } 1 \leq n \leq 6\right\}$

9. We have, $A \cup B = \{ a, e, i, o, u \} = A$. This example illustrates that union of sets A and its subset B is the set A itself, i.e., if $B \subset A$, then $A \cup B = A$.

10. We have, $X \cup Y$ = {Ram, Geeta, Akbar, David, Ashok}. This is the set of students from Class XI who are in the hockey team or the football team or both.

11. We see that 6, 8 are the only elements which are common to both A and B. Hence $A \cap B = \{ 6, 8 \}$.

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