Solution

SETS WS

Class 11 - Mathematics

1. **(a)** A

   Explanation: Since, $A \subseteq A \cup B$, therefore, $A \cap (A \cup B)$ = A

2.

   (b) {3, 6, 9, 12, 18, 21, 24, 27}

   Explanation: Since set B represent multiple of 5 so from Set A common multiple of 3 and 5 are excluded.

3.

   (d) {1, 2, 3, 4}

   Explanation: Given A = {1, 2, 3}, B = {3, 4} and C = {4, 5, 6}

   B ∩ C = {4}

   A ∪ (B ∩ C) = {1, 2, 3, 4}

4.

   (c) {3, 5, 9}

   Explanation: The union of two sets A and B is the set of elements in A, or B, or both.

   So smallest set A = {3, 5, 9}

5. **(a)** 63

   Explanation: 63

   The no. of proper subsets = $2^n - 1$

   Here n(A) = 6

   In case of the proper subset, the set itself is excluded that's why the no. of the subset is 63. But if it is asked no. of improper or just no. of subset then you may write 64

   So no. of proper subsets = 63

6.

   (c) A

   Explanation: We have to find (A')' = ?

   Now, A = U\A

   ⇒ (A')' = (U\A)' = U'\A'

   ⇒ (A')' = U'\(U\A)

   ⇒ (A')' = U'\(U\A)

   ⇒ (A')' = A

7. **(a)** N

   Explanation: We have,A′ ∪ (A ∪ B) ∩ B′

   = A′ ∪ [(B’ ∩ A) ∪ (B’ ∩ B)] {∵ Distributive property of set: (A ∩ B) ∪ (A ∩ C) = A ∩ (B ∪ C)}

   = A′ ∪ [(A ∩ B’) ∪ Φ] {∵ (B’ ∩ B) = ϕ}

   = A′ ∪ (A ∩ B’) = (A’ ∪ A) ∩ (A’ ∪ B’) {∵ Distributive property of set: (A ∪ B) ∩ (A ∪ C) = A ∪ (B ∩ C)}

   = Φ ∩ (A’ ∪ B’) {∵ (A’ ∩ A) = ϕ}

   = (A’ ∪ B’) = (A ∩ B)’ {∵ (A’ ∪ B’)

   = (A ∩ B)’} A′ ∪ (A ∪ B) ∩ B′ = (A ∩ B)’

   A contains all odd numbers and B contains all even numbers

   Therefore, A ∩ B = ϕ

   ⇒ A′ ∪ (A ∪ B) ∩ B′ = {ϕ}’

   ⇒ A′ ∪ (A ∪ B) ∩ B′ = N

8.

   (c) A

   Explanation: The set is {a, e, i, o, u}

9.

   (d) C - D = E

Explanation: C - D = {a, b, c} - {c, d} = {a, b}
But E = {d}
Hence C - D $\neq$ E

10.

(c) A $\cap$ B = ϕ
Explanation: We have,A = $\left\{(x, y) | y = \frac{1}{x}, 0 \neq x \in \mathbf{R}\right\}$ and B = {(x, y) | y = -x, x $\in$ R}
For any element of A $\cap$ B, A and B will have same value of y
$\Rightarrow$ $-x^2 = 1$
$\Rightarrow$ $x^2 = -1$
Square of any value cannot be negative
Thus, there is no value of x for which A and B will have same value of y
$\Rightarrow$ A $\cap$ B = ϕ

11.

(b) $A \subseteq B$
Explanation: $A \subseteq B$
$\Rightarrow$ since set A is totally contained in Set B.

12.

(d) $B^c \subset A^c$
Explanation: Let A $\subset$ B
To prove $B^c \subset A^c$, it is enough to show that $x \in B^c \Rightarrow x \in A^c$
Let $x \in B^c$
$\Rightarrow$ x $\notin$ B
$\Rightarrow$ x $\notin$ A since A $\subset$ B
$\Rightarrow$ $x \in A^c$
Hence $B^c \subset A^c$

13. **(a)** {2, 3, 5, 7}
Explanation: Prime no. less then 10 is 2, 3, 5, 7 so
Set A = {2, 3, 5, 7}

14.

(c) 2^n
Explanation: The total no of subsets = 2^n

15.

(b) None of these
Explanation: 4 $\notin$ A
{4} $\not\subset$ A
B $\not\subset$ A
Therefore, we can say that none of these options satisfy the given relation.

16.

(c) 2^n
Explanation: 2^n
The total number of subsets of a finite set consisting of n elements is 2^n.

17.

(d) $\{x : x \in R,\ 4 \leq x < 5\}$
Explanation: Set A represents the elements which are greater or equals to 4 and the elements are real no. A$[4, \infty)$
Set B represents the elements which are less than 5 and are real no. B$(-\infty, 5)$
So if we represent these two in number line we can see the common region is between 4(included) and 5(excluded).

18. **(a)** A and the complement of B are always non-disjoint
Explanation: Let x $\in$ A, then x $\notin$ B as A is not a subset of B
$\therefore$ x $\in$ A and x $\notin$ B

$\Rightarrow$ x $\in$ A and x $\in$ B'
$\Rightarrow$ x $\in$ A $\cap$ B'
$\Rightarrow$ A and B' are non - disjoint.

19.
(d) four points
Explanation: From A, $x^2 + y^2 = 25$ and from B, $x^2 + 9y^2 = 144$
$\therefore$ From B, $(x^2 + y^2) + 8y^2 = 144$
$\Rightarrow 25 + 8y^2 = 144$
$\Rightarrow 8y^2 = 119$
$\Rightarrow y = \pm\sqrt{\frac{119}{8}}$
$\therefore x^2 + y^2 = 25 \Rightarrow x^2 = 25 - y^2 = 25 - \frac{119}{8} = \frac{81}{8}$
$\Rightarrow x = \pm\sqrt{\frac{81}{8}}$
Since we solved equations simultaneously, therefore $A \cap B$ has four points A has 2 elements & B has 2 elements.

20.
(b) 7
Explanation: The no. of proper subsets = $2^n - 1 = 2^3 - 1 = 7$
Here n = no of elements of given set = 3.

21.
(b) 32
Explanation: In any set having 'n' elements the total no of subsets = 2^n
So total subset = $2^5 = 32$

22.
(d) B $\subseteq$ A
Explanation: A $\cap$ B = B which means elements of B are in the both sets A and B.
$\Rightarrow$ All the elements of B are contained in the intersection of A and B which is equal to B.
$\Rightarrow$ B $\subseteq$ A.

23.
(d) (4, 5)
Explanation: We have,A ={x : x $\in$ R, x > 4} and B = {x $\in$ R : x < 5}
A $\cap$ B = (4, 5)

24.
(c) A
Explanation: Let us assume that x $\in$ A $\cap$ (A $\cup$ B)
$\Rightarrow$ x $\in$ A and x $\in$ (A $\cup$ B)
$\Rightarrow$ x $\in$ A and (x $\in$ A or x $\in$ B)
$\Rightarrow$ (x $\in$ A and x $\in$ A) or (x $\in$ A and x $\in$ B)
$\Rightarrow$ x $\in$ A or x $\in$ A $\cap$ B
$\Rightarrow$ x $\in$ A
Therefore, A $\cap$ (A $\cup$ B) = A

25. **(a)** B = C
Explanation: A $\cup$ B = A $\cup$ C
$\Rightarrow$ (A $\cup$ B) $\cap$ C = (A $\cup$ C) $\cap$ C
$\Rightarrow$ (A $\cap$ C) $\cup$ (B $\cap$ C) = C .....(i)
Now again A $\cup$ B = A $\cup$ C
$\Rightarrow$ (A $\cup$ B) $\cap$ B = (A $\cup$ C) $\cap$ B
$\Rightarrow$ B = (A $\cap$ B) $\cup$ (C $\cap$ B)
$\Rightarrow$ B = (A $\cap$ C) $\cup$ (C $\cap$ B), Since (A $\cap$ B) = (A $\cap$ C)
$\Rightarrow$ (A $\cap$ C) $\cup$ (B $\cap$ C) = B .....(ii)
Now from (i) and (ii) we get B = C

26.

(c) R = {(x, y) : 0 < x < a, 0 < y < b}

Explanation: We have, R be set of points inside a rectangle of sides a and b

Since, a, b > 1

a and b cannot be equal to 0

Thus,R = {(x, y) : 0 < x < a, 0 < y < b}

27. **(a)** C = ϕ

Explanation: ϕ is denoted as null set.

28.

(d) (x: x $\neq$x).

Explanation: (x: x $\neq$x). x is not equal to x is null set as it refers to there is no element in the set.And it also representing the set builder form pattern

29.

(c) 45

Explanation: Now to find value of n

Since elements are not repeating, number of elements in $A_1 \cup A_2 \cup A_3 \cup \ldots\ldots\ldots \cup A_{30}$ is 30 $\times$ 5

But each element is used 10 times

Thus, 10 $\times$ S = 30 $\times$ 5

$\Rightarrow$ 10 $\times$ S = 150

$\Rightarrow$ S = 15

Since elements are not repeating, number of elements in $B_1 \cup B_2 \cup B_3 \cup \ldots\ldots\ldots \cup B_n$ is 3 $\times$ n

But each element is used 9 times

Thus, 9 $\times$ S = 3 $\times$ n

$\Rightarrow$ 9 $\times$ S = 3n

$\Rightarrow S = \frac{n}{3}$

$\Rightarrow \frac{n}{3} = 15$

$\Rightarrow$ n = 45

Therefore, the value of n is 45

30.

(b) { }

Explanation: Here value of x is not possible so A is a null set.

31.

(d) 6, 3

Explanation: Let A and B be two sets having m and n elements respectively. Then,

Number of subsets of A = 2^m, Number of subsets of B = 2^n

It is given that $2^m - 2^n = 56$

So, $2^n(2^{m-n} - 1) = 2^3(2^3 - 1)$

n = 3 and m - n = 3 $\Rightarrow$ n = 3 and m = 6.

32.

(b) 20

Explanation: The correct answer is (B)

Since, $n(X_r) = 5$, $\bigcup_{r=1}^{20} X_r$ = S, we obtain n(S) = 100

But each element of S belong to exactly 10 of the X ’s

Thus, $\frac{100}{10}$ = 10 are the number of distinct elements in S.

Also each element of S belong to exactly 4 of the Y_r’s and each $Y_{r's}$contain 2 elements. If S has n number of Y_r in it.

Then $\frac{2n}{4}$ = 10

which gives n = 20

33.

(d) 6, 3

Explanation: Since, let A and B be such sets, i.e., n (A) = m, and n(B) = n

Thus, n (P(A)) = 2^m , n (P(B)) = 2^n

Therefore, n (P(A)) – n (P(B)) = 56, i.e., $2^m - 2^n = 56$

⇒ $2^n (2^{m-n} - 1) = 2^3\ 7$

⇒ n = 3, $2^{m-n} - 1 = 7$

⇒ m = 6

34. **(a)** 2^n

Explanation: 2^n

The no. of subsets containing n elements is 2^n.

35.

(d) $B \subseteq A$

Explanation: $B \subseteq A$

Because B is contained in A..So the union of these two will be A

36. **(a)** 1 ∈ Q

Explanation: N is set of natural number, so

x = $\frac{1}{y}$

When y = 1 then x = 1

So, 1 ∈Q

37.

(d) 15

Explanation: Total no. of subset including empty set = 2^n

So total subset = 2^4 = 16

The no. of non empty set = 16 - 1 = 15

38. **(a)** an infinite set

Explanation: Set A = {2, 3, 5, 7,...} so it is infinite.

39. **(a)** 41

Explanation: We have to find ,n(S) + n(P)

S = {x | x is a positive multiple of 3 less than 100}

⇒ S = {3, 6, 9, 12, 15,……, 99}

⇒ $n(S) = \frac{99}{3} = 33$

P = {x | x is a prime number less than 20}

⇒ P = {2, 3, 5, 7, 11, 13, 17, 19}

⇒ n(P) = 8

n(S) + n(P) = 33 + 8 = 41

Therefore, answer is 41

40.

(b) A

Explanation: $(A \cap B') = A$

⇒ $A \cap (A \cap B') = A \cap A = A$

41.

(d) { }

Explanation: { } denoted as null set and Null set is subset of all sets.

42.

(c) 21N

Explanation: Here 3N = {3, 6, 9,...} and 7N = {7, 14, 21,...}

Hence 3N ∩ 7N = {21, 42, ...} = {21x : x ∈ N} = 21N

43.

(d) A

Explanation: Common between set A and $(A \cup B)$is set A itself

44.

(c) 7, 4

Explanation: Now to find value of m and n

The number of subsets of a set containing x elements is given by 2^x

According to question: $2^m - 2^n = 112$

$\Rightarrow 2^n (2^{m-n} - 1) = 16 \times 7$

$\Rightarrow 2^n (2^{m-n} - 1) = 2^4 \times 7$

On comparing on both sides $2^n = 2^4$ and $2^{m-n} - 1 = 7$

$\Rightarrow n = 4$ and $2^{m-n} = 8$

$\Rightarrow 2^{m-n} = 2^3$

$\Rightarrow m - n = 3$

$\Rightarrow m - 4 = 3$

$\Rightarrow m = 7$

Therefore,the value of m and n is 7 and 4 respectively

45.

(b) ϕ

Explanation: We have, $A \cap (A \cup B)' = A \cap (A' \cap B')$

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

$= \phi \cap (A \cap B')$

$= \phi$

46.

(c) $A \cap B^c$

Explanation: $A \cap B^c$

A and B are two sets.

$A \cap B$ is the common region in both the sets.

$(A \cap B^c)$ is all the region in the universal set except $A \cap B$

Now, $A \cap (A \cap B)^c = A \cap B^c$

47.

(c) $B \subseteq A$

Explanation: The union of two sets is a set of all those elements that belong to A or to B or to both A and B.

If $A \cup B = A$, then $B \subseteq A$

48.

(d) $F_2 \cup F_3 \cup F_4 \cup F_1$

Explanation: We know that

Every rectangle, square and rhombus is a parallelogram

But, no trapezium is a paralleogrm

Thus, $F_1 = F_2 \cup F_3 \cup F_4 \cup F_1$

49.

(d) $S \cup T \cup C = S$

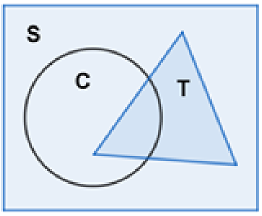
Explanation: Given,

S = set of points inside the square,

T = the set of points inside the triangle and

C = the set of points inside the circle

Since, the triangle and circle intersect each other and are contained in a square.



Clearly,hence $S \cup T \cup C = S$

50.

(c) 1 and 2

Explanation:

I. $A-(A\cap B)=A\cap(A\cap B')$ $[\because A-B=A\cap B']$

$=A\cap(A'\cap B')$ [By De - morgan's law]

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

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

II. $(A\cap B)\cap(A-B)=(A\cap B)\cup(A\cap B')$

$=X\cup(A\cap B')$ Where X = $A\cap B$

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

$=\mathrm{A}\cap(\mathrm{A}\cup\mathrm{B'})\,[\mathrm{X}\cup\mathrm{A}=(\mathrm{A}\cap\mathrm{B})\cup\mathrm{A}=\mathrm{A}\cup\mathrm{B'}]\;=\mathrm{A}(\because \mathrm{AB}\subset\mathrm{A})\mathrm{X}\cup\mathrm{B'}$

$=(\mathrm{A}\cap\mathrm{B})\cup\mathrm{B'}=(\mathrm{A}\cup\mathrm{B'})\cap(\mathrm{B}\cup\mathrm{B'})=(\mathrm{A}\cup\mathrm{B'})\cap\mathrm{U}$

$=\mathrm{A}\,[\because \mathrm{A}\subset\mathrm{A}\cup\mathrm{B'}]$

III. This is correct because,

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