

SETS

Class IX, Mathematics IIT FOUNDATION + SOLUTIONS

①

TEACHING TASK

01. $A = \{1, 2, 3, 4\} \Rightarrow n(A) = 4$

$$\therefore n[P(A)] = 2^n = 2^4 = 16$$

opt: 3

02. $A \cup B \cup C = \{1, 2, 3, 4, 5, 6\}$

opt: 4

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

$$= \{1, 2, 3\} \cup \{ \}$$

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

opt: 4

04. $A^c = U - A$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{5, 6, 7, 8, 9, 10\}$$

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

opt: 1

05. $A = \left\{ \frac{2}{3} \right\}, B = \{0\}$

only A and B are singleton sets

opt: 3

06. $A = \{x: x < 1 \text{ and } x > 3\}$

$$B = \{x: x^2 = 9 \text{ and } 3x = 7\}$$

These two sets are null sets.

opt: 2

07. $n(A) = 7$

$$\text{No. of proper subsets of } A = 2^n - 1$$

$$= 2^7 - 1$$

opt: 3

08. $B - A = \{1, 4, 6, 9\} - \{4, 5, 8, 12\}$

(2)

$$= \{1, 6, 9\}$$

$$A - (B - A) = \{4, 5, 8, 12\} - \{1, 6, 9\}$$

$$= \{4, 5, 8, 12\}$$

opt: 1

09. ~~A~~ clearly $A - (B \cup C) = (A - B) \cap (A - C)$

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

opt: 4

10. $A = \{1, 3, 7, 15, 31\}$, $B = \{2, 4, 8, 16\}$

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

$$= \{1, 3, 7, 15, 31\} \cup \{2, 4, 8, 16\}$$

$$= \{1, 2, 3, 4, 7, 8, 16, 31\}$$

opt: 2

11. $\{x : |x| = 5, x \in \mathbb{N}\} = \{\pm 5\}$

$$\{x : |x| = 6, x \in \mathbb{Z}\} = \{\pm 6\}$$

$$\{x : x^2 + 2x + 1 = 0, x \in \mathbb{N}\} = \emptyset$$

$$\{x : x^2 = 7, x \in \mathbb{N}\} = \emptyset$$

Ans: 1, 2, 3, 4

12. $A \cap B = A \cap C$ and $A \cup B = A \cup C$

If $B = C$, then $A \cap C = A \cap C$, $A \cup C = A \cup C$ which are true.

If A

Ans: opt: 2

13. Statement I: $\{a, e, i, o, u\}$ finite set

Statement II: clearly it is true

Ans: opt: 1

14. Statement I: $2^1 = 2^3 = 8$ (TRUE)

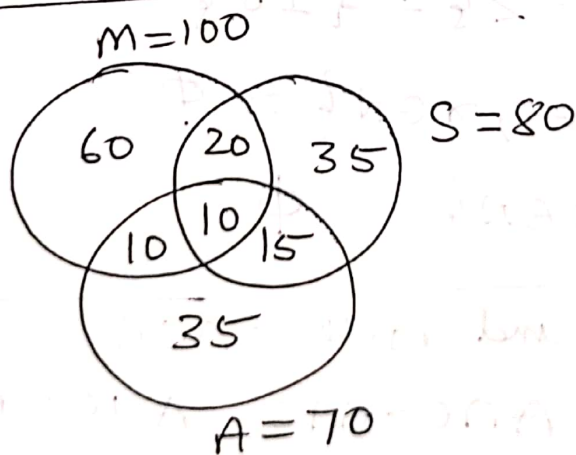
Statement II: clearly it is true Ans: opt: 1

- 15 (i) There will be infinite lines parallel to the x-axis $\rightarrow$ Infinite set (3)
 (ii) $\{A, B, C, \dots, x, y, z\} \rightarrow$ finite set
 (iii) Animals on Earth $\rightarrow$ ☒ finite set
 (iv) Circles through origin $\rightarrow$ Infinite set
 Ans: Opt: 3

16. (i) Prime numbers set $\rightarrow$ Infinite set
 (ii) Human beings $\rightarrow$ finite set
 (iii) Real numbers between 1 and 2 $\rightarrow$ Infinite set
 (iv) Multiples of 3 $\rightarrow$ Infinite set
 Ans: opt: 1

17. (i) Finite set (ii) Infinite set
 (iii) Finite set (iv) Infinite set
 Ans: opt: 2

18



Exactly two activities = $20 + 10 + 15 = 45$
 Ans: opt: C

19. Do not participate = $200 - (60 + 20 + 35 + 10 + 10 + 15 + 35)$
 $= 200 - 185$
 $= 15$

$$21. A = \{3, 9, 27, 81, 243, 729\}$$

$$B = \{9, 81, 729, 6561\}$$

$$\therefore n(A) = 6, n(B) = 4, n(A \cap B) = 3$$

$$n(A \cup B) = 6 + 4 - 3 = 7$$

$$22. a) (A \cap B)^c = \mu - (A \cap B)$$

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

$$c) (A - B) \cap (B - A) = \phi$$

$$d) A \cap B = \phi \Rightarrow n(A \cap B) = 0$$

Ans: p, s, q, t

$$23. a) A = \{1, 2, 3, 4, 5, 6, 7\}, B = \{3, 6, 7, 9\}$$

$$\text{Total subsets of } A = 2^7 = 128$$

$$C \cap B = \phi \Rightarrow \text{set } C \text{ contains the elements } 1, 2, 4, 5$$

$$\therefore S = \{C \subseteq A : C \cap B \neq \phi\}$$

$$= \text{total} - (C \cap B = \phi)$$

$$= 128 - 2^4$$

$$= 112$$

$$b) A = \{n \in \mathbb{N} : \text{H.C.F.}(n, 45) = 1\}$$

$$45 = 3 \times 5, \text{ then}$$

Here

'A' must be a set that does not consist of either 3 multiples or 5 multiples

$$\Rightarrow A = \{1, 2, 4, 7, 8, 11, 13, \dots\}$$

$$B = \{2K : K \in \{1, 2, 3, \dots, 100\}\} \quad (5)$$

$$B = \{2, 4, 6, \dots, 200\}$$

$$\text{Now } A \cap B = \{1, 2, 4, 7, 8, 11, 13, 14, \dots\} \cap \{2, 4, 6, \dots, 200\}$$

$$= \{2, 4, 8, 14, \dots, 200\}$$

To find the sum of the elements in

$$A \cap B = 2 + 4 + 8 + 14 + \dots + 200$$

$$= 2 [1 + 2 + 4 + 7 + \dots + 100]$$

$$= 2 \left[\text{Sum of the natural numbers up to } 100 - \text{Sum of multiples of } (3, 5) \right]$$

$$= 2 \left[\frac{100 \times 101}{2} - \left[3 \times \left(\frac{33 \times 34}{2} \right) + 5 \times \left(\frac{20 \times 21}{2} \right) - 15 \times \left(\frac{6 \times 7}{2} \right) \right] \right]$$

$$= 10100 - 3366 - 2100 + 630$$

$$= 5264$$

$$c) \quad n^2 - n - 10,000 \leq 0$$

$$n \in \left(\frac{1 - \sqrt{40001}}{2}, \frac{1 + \sqrt{40001}}{2} \right)$$

But $n \in \mathbb{N}$

$$\therefore A = \{1, 2, 3, \dots, 100\}$$

$$B = \{4, 7, 10, 13, \dots\}$$

$$C = \{2, 4, 6, 8, \dots\}$$

(6)

$$B - C = \{7, 13, 19, \dots, 97, \dots\}$$

$$A \cap (B - C) = \{7, 13, 19, \dots, 97\}$$

$$\text{Sum} = \frac{16}{2} [7 + 97] = 832$$

$$d) X = \{x : 1 \leq x \leq 50, x \in \mathbb{N}\}$$

$$A = \{n \mid n \text{ is a multiple of } 2\}$$

$$A = \{2, 4, 6, \dots, 50\}$$

$$\therefore n(A) = 25, n(B) = 7$$

$$n(A \cap B) = 3$$

$$\therefore n(A \cup B) = 25 + 7 - 3$$

$$= 29$$

Ans: 29, 2, 4, 6

LEARNERS TASK

Q1's

01. opt: 4 is not well defined collections

Ans: opt 4

02. x is positive integer and $x^2 < 40$

$$= \{1, 2, 3, 4, 5\}$$

Ans: opt 1

$$03. \{1, 3, 5, 7, 9, 11, 13\}$$

Ans: opt 2

04. $\{x \mid x \text{ is odd natural number } \& x < 15\}$

Ans: opt: 3

05. Conceptual

Ans: opt: 3

06. Conceptual

Ans: opt: 4

$$07. n(S) = 5$$

Ans: opt 1



08. $\{4, 5, 6, 7, 8, 9\}$ Ans: opt: 4 ⑦

09. $\{-2, -1, 0, 1, 2, 3, 4, 5, 6\}$ Ans: opt: 3

10. Conceptual Ans: opt: 2

JEE MAIN LEVEL

01. $A \cup B = x \in A \text{ or } x \in B$ Ans: opt: 1

02. $A \cup B = \{1, 2, 3, 4, 5, 6\}$ Ans: opt: 3

03. $A \cap B = \{1, 4, 6\}$ Ans: opt: 2

04. $A \cap B = \phi$ Ans: opt: 3

05. $n(A) = 8$ Ans: opt: 2

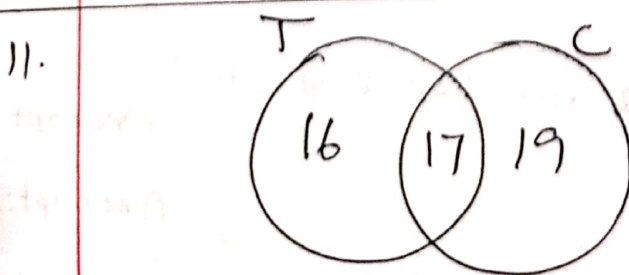
06. $A = \{1, 4, 9, 16, 25\}$, $n(A) = 5$ Ans: opt: 3

07. $A - B = \{1, 2, 3\}$ Ans: opt: 1

08. $A^c = \{6, 7, 8, 9, 10\}$ Ans: opt: 2

09. $A \subset B$, $A \cap B = A$ Ans: opt: 1

10. Clearly (iii), (iv) are sets Ans: opt: 3



Clearly options (1), (4) are correct



12 Let $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$

(8)

and $C = \{1, 2, 3, 5, 6\}$

clearly $A \cap B = \{2, 3\} \neq \phi$

and also $A \cap B \subseteq C$

1) $A - C = \phi \subseteq B$

Now $A \subseteq B$, which is false

2) $C \cup A = \{1, 2, 3, 5, 6\}$

$C \cup B = \{1, 2, 3, 5, 6\}$

$(C \cup A) \cap (C \cup B) = \phi = B$, which is false

3) $B \cap C = \{2, 3, 4\} \neq \phi$, which is true

4) $A - B = \{1\} \subseteq C \Rightarrow A \subseteq C$, which is true

Ans: options: 1, 2

13. Statement I
 $A = \{2, 4, 6, 8, \dots\}$

$B = \{1, 3, 5, 7, \dots\}$

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

$= \phi \cup \phi$

$= \phi$

Statement II: Conceptual

Statement II: Conceptual

Ans: opt: A

14. Statement I:

9

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

$$= 37 + 26 - 51$$

$$= 12$$

Statement II: Conceptual

Ans: opt: A

15. $A = \{3, 5, 7, 9, 11\}$

$$B = \{1, 4, 7, 10\}$$

$$A \cup B = \{1, 3, 4, 5, 7, 9, 10, 11\}$$

Ans: opt: 3

16. Clearly $y = \{3, 5, 9\}$ is the smallest set

Ans: opt: 1

17. $A = \{-2, -1, 0, 1, 2\}$

$$B = \{0, 1, 2, 3\}$$

$$C = \{1, 2\}$$

$$A \cup B \cup C = \{-2, -1, 0, 1, 2, 3\}$$

$$n(A \cup B \cup C) = 6$$

$$A \cap (B \cap C) = \{1, 2\}$$

$$n(A \cap (B \cap C)) = 2$$

Ans: opt: 4

18. Given $A = \{1, 2, 3\} \Rightarrow n(A) = 3$

(10)

No. of proper subsets $= 2^n - 1$
 $= 2^3 - 1$

Ans. opt: 2

19. Given $A = \{1, 2, 3\} \Rightarrow n(A) = 3$

No. of subsets $= 2^n = 2^3$

Ans. opt: 1

20. Given $A = \{1, 2, 3\}$

Improper subset $= \{1, 2, 3\}$

No. of improper subset $= 1$

Ans. opt: 1

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

$y = 9 + 9 - 0$

Ans: 9

$\Rightarrow y - 9 = 9$

22. Given $S = \{4, 6, 9\}$, $T = \{9, 10, 11, \dots, 1000\}$

$A = \{a_1 + a_2 + a_3 + \dots + a_k, k \in \mathbb{N}\}$

Here by the definition of A

$A = \{a: a = 4x + 6y + 9z\}$

Except the element 11, every element of set T is of the form $4x + 6y + 9z$ for some $x, y, z \in \mathbb{W}$

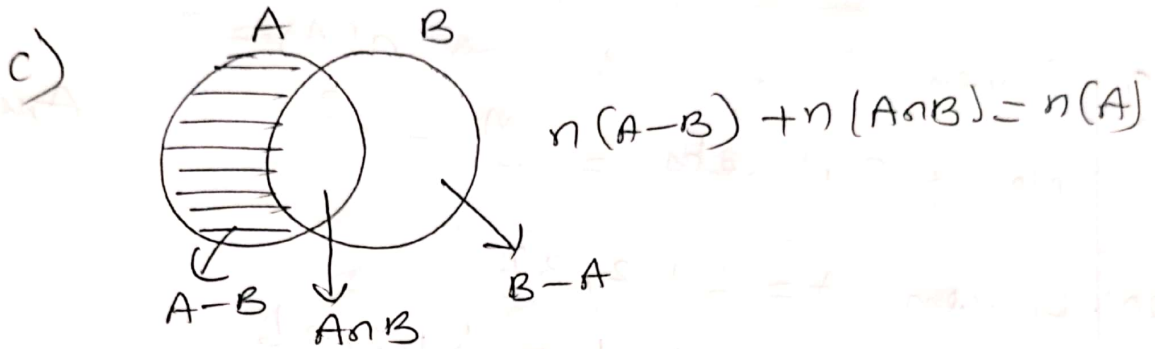
$\therefore T - A = \{11\}$

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

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

$$\begin{aligned}
 b) \quad n(A \cup B) &= n(A) + n(B) - n(A \cap B) \\
 &= n(A) + n(B) - \phi \\
 &= n(A) + n(B)
 \end{aligned}$$

(11)



$$d) \quad n(B-A) + n(A \cap B) = n(B)$$

Ans: S, S, P, X

24. a) $x \in A \cap B = x \in A \text{ and } x \in B$

b) $x \notin A-B = x \notin A \text{ or } x \in B$

c) $x \notin A \cup B = x \notin A \text{ and } x \notin B$

d) $x \in A-B = x \in A \text{ and } x \notin B$

Ans: X, -, P, V

ADDITIONAL PRACTICE

QUESTIONS FOR STUDENTS

1. The collection of all rich persons in India is not a set

Ans: 1

2. clearly (i) and (iii) are only sets

Ans: 3

4. $A = \phi$, $P(A)$ has one element (12) Ans: opt: 1

5. only (i) is the set Ans: opt: 1

6 $A \cup B = \{1, 2, 3, 4, 5\}$

Ans: opt: 2

7 clearly $1 \in \mathbb{Q}$

RELATIONS