JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- MATHEMATICS

CLASS :- 11th **PAPER CODE :- CWT-1**

CHAPTER :- SET

ANSWER KEY

1.	(B)	**2.**	(C)	**3.**	(B)	**4.**	(C)	**5.**	(A)	**6.**	(C)	**7.**	(A)
8.	(C)	**9.**	(C)	**10.**	(D)	**11.**	(B)	**12.**	(C)	**13.**	(D)	**14.**	(B)
15.	(D)	**16.**	(D)	**17.**	(A)	**18.**	(B)	**19.**	(D)	**20.**	(C)	**21.**	9
22.	32	**23.**	10	**24.**	160	**25.**	12	**26.**	43	**27.**	22	**28.**	16
29.	2	**30.**	8										

SOLUTIONS

1. (B)

Sol. $n(A)$ = 40% of 10,000 = 4,000

$n(B)$ = 20% of 10,000 = 2,000

$n(C)$ = 10% of 10,000 = 1,000

$n(A \cap B)$ = 5% of 10,000 = 500

$n(B \cap C)$ = 3% of 10,000 = 300

$n(C \cap A)$ = 4% of 10,000 = 400

$n(A \cap B \cap C)$ = 2% of 10,000 = 200

We want to find $n(A \cap B^c \cap C^c) = n[A \cap (B \cup C)^c]$

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

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

= 4000 – [500 + 400 – 200] = 4000 – 700 = 3300.

2. (C)

Sol. $n(C) = 20$, $n(B) = 50$, $n(C \cap B) = 10$

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

= 20 + 50 – 10 = 60.

Hence, required number of persons = 60%.

3. (B)

Sol. Since $\frac{1}{y} \neq 0, \frac{1}{y} \neq 2, \frac{1}{y} \neq \frac{-2}{3}$, $[\because y \in N]$

$\therefore$ $\frac{1}{y}$ can be 1, [$\because$ y can be 1].

4. (C)

Sol. Let $x \in A \Rightarrow x \in A \cup B$, $[\because A \subseteq A \cup B]$

$\Rightarrow x \in A \cap B$, $[\because A \cup B = A \cap B]$

$\Rightarrow x \in A$ and $x \in B \Rightarrow x \in B$, $\therefore A \subseteq B$

Similarly, $x \in B \Rightarrow x \in A$, $\therefore B \subseteq A$

Now $A \subseteq B, B \subseteq A \Rightarrow A = B$.

5. (A)

Sol. $A \cap B = \{2,3,4,8,10\} \cap \{3,4,5,10,12\}$

$= \{3,4,10\}$, $A \cap C = \{4\}$.

$\therefore (A \cap B) \cup (A \cap C) = \{3,4,10\}$.

6. (C)

Sol. $A \cap (A \cup B)' = A \cap (A' \cap B')$,

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

$= (A \cap A') \cap B'$, (by associative law)

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

$= \phi$.

7. (A)

Sol. $3N = \{x \in N : x$ is a multiple of 3$\}$

$7N = \{x \in N : x$ is a multiple of 7$\}$

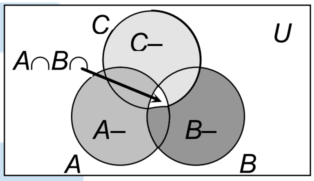
$\therefore 3N \cap 7N = \{x \in$ is a multiple of 3 and 7$\}$

$= \{x \in N : x$ is a multiple of 3 and 7$\}$

$= \{x \in N : x$ is a multiple of 21$\} = 21N$.

8. (C)

Sol. From *Venn-Euler's* Diagram,



Clearly,

$\{(A-B) \cup (B-C) \cup (C-A)\}' = A \cap B \cap C$.

9. (C)

Sol. Let A denote the set of Americans who like cheese and let B denote the set of Americans who like apples.

Let Population of American be 100.

Then $n(A) = 63, n(B) = 76$

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

$= 63 + 76 - n(A \cap B)$

$\therefore n(A \cup B) + n(A \cap B) = 139$

$\Rightarrow n(A \cap B) = 139 - n(A \cup B)$

But $n(A \cup B) \le 100$

$\therefore -n(A \cup B) \ge -100$

$\therefore 139 - n(A \cup B) \ge 139 - 100 = 39$

$\therefore n(A \cap B) \ge 39$ *i.e.*, $39 \le n(A \cap B)$ .....(i)

Again, $A \cap B \subseteq A, A \cap B \subseteq B$

$\therefore n(A \cap B) \le n(A) = 63$ and

$n(A \cap B) \le n(B) = 76$

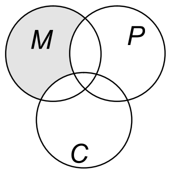
$\therefore n(A \cap B) \le 63$ .....(ii)

Then, $39 \le n(A \cap B) \le 63 \Rightarrow 39 \le x \le 63$.

10. (D)
Sol. $A - B = \{x : x \in A$ and $x \notin B\}$
$= \{x : x \in A$ and $x \in B^c\} = A \cap B^c$.

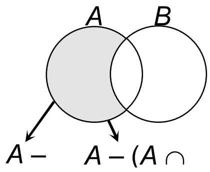
11. (B)
Sol. $A = \{4, 8, 12, 16, 20, 24, ...\}$
$B = \{6, 12, 18, 24, 30, ...\}$
$\therefore A \subset B = \{12, 24, ...\}$ = {x : x is a multiple of 12}.

12. (C)
Sol. n(M alone)
$= n(M) - n(M \cap C) - n(M \cap P) + n(M \cap P \cap C)$



$= 100 - 28 - 30 + 18 = 60$.

13. (D)
Sol. $A - B = A - (A \cap B)$ is correct.
$A = (A \cap B) \cup (A - B)$ is correct.



(3) is false.
$\therefore$ (1) and (2) are true.

14. (B)
Sol. $n((A \times B) \cap (B \times A))$
$= n((A \cap B) \times (B \cap A)) = n(A \cap B).n(B \cap A)$
$= n(A \cap B).n(A \cap B) = (99)(99) = 99^2$.

15. (D)
Sol. $n(A \cup B) = n(A) + n(B) - n(A \cap B) = 12 + 9 - 4 = 17$
Now,
$n((A \cup B)^C) = n(U) - n(A \cup B) = 20 - 17 = 3$.

16. (D)
Sol. $n(M) = 23$, $n(P) = 24$, $n(C) = 19$
$n(M \cap P) = 12$, $n(M \cap C) = 9$, $n(P \cap C) = 7$
$n(M \cap P \cap C) = 4$
We have to find $n(M \cap P' \cap C')$, $n(P \cap M' \cap C')$, $n(C \cap M' \cap P')$
Now $n(M \cap P' \cap C') = n[M \cap (P \cup C)']$
$= n(M) - n(M \cap (P \cup C))$
$= n(M) - n[(M \cap P) \cup (M \cap C)]$
$= n(M) - n(M \cap P) - n(M \cap C) + n(M \cap P \cap C)$
$= 23 - 12 - 9 + 4 = 27 - 21 = 6$
$n(P \cap M' \cap C') = n[P \cap (M \cup C)']$
$= n(P) - n[P \cap (M \cup C)] = n(P) - n[(P \cap M) \cup (P \cap C)]$
$= n(P) - n(P \cap M) - n(P \cap C) + n(P \cap M \cap C)$
$= 24 - 12 - 7 + 4 = 9$
$n(C \cap M' \cap P') = n(C) - n(C \cap P) - n(C \cap M) + n(C \cap P \cap M)$
$= 19 - 7 - 9 + 4 = 23 - 16 = 7$.

17. (A)
Sol. It is distributive law

18. (B)
Sol. It is De' Morgan law.

19. (D)
Sol. A set is a well-defined finite collection of distinct objects, considered as an object in its own right
From the given data, we can't find the exact no.of students in the class which are intelligent. So, it is not well-defined.
Hence, the given set is not a well-defined collection.

20. (C)
Sol. A=(x,y) are points on the curve $y=e^x$
B=(x,y) are points on the line y=x
It can be observed from figure that both the curves have no point of intersection for all x∈R Therefore, $A \cap B = \phi$
Hence, option 'C' is correct.

21. 9
Sol. $A \times B$ = {(2, 7), (2, 8), (2, 9), (4, 7), (4, 8), (4, 9), (5, 7), (5, 8), (5, 9)}
$n(A \times B) = n(A) \cdot n(B) = 3 \times 3 = 9$.

22. 32
Sol. $S = \{0, 1, 5, 4, 7\}$,
then, total number of subsets of S is 2^n.
Hence, $2^5 = 32$.

23. 10
Sol. Minimum value of
$n = 100 - (30 + 20 + 25 + 15))$
$= 100 - 90 = 10$.

24. 160
Sol. $n(C) = 224, n(H) = 240, n(B) = 336$
$n(H \cap B) = 64$, $n(B \cap C) = 80$
$n(H \cap C) = 40$, $n(C \cap H \cap B) = 24$
$n(C^c \cap H^c \cap B^C) = n[(C \cup H \cup B)^c]$
$= n(\cup) - n(C \cup H \cup B)$
$= 800 - [n(C) + n(H) + n(B) - n(H \cap C)$
$- n(H \cap B) - n(C \cap B) + n(C \cap H \cap B)]$
$= 800 - [224 + 240 + 336 - 64 - 80 - 40 + 24]$
$= 800 - 640 = 160$.

25. 12

Sol. Let $n(P)$ = Number of teachers in Physics.

$n(M)$ = Number of teachers in Maths

$$n(P \cup M) = n(P) + n(M) - n(P \cap M)$$

$$20 = n(P) + 12 - 4 \Rightarrow n(P) = 12.$$

26. 43

Sol. Let B, H, F denote the sets of members who are on the basketball team, hockey team and football team respectively.

Then we are given

$n(B) = 21, n(H) = 26, n(F) = 29$

$n(H \cap B) = 14$, $n(H \cap F) = 15$, $n(F \cap B) = 12$

and $n(B \cap H \cap F) = 8$.

We have to find $n(B \cup H \cup F)$.

To find this, we use the formula

$n(B \cup H \cup F) = n(B) + n(H) + n(F)$

$-n(B \cap H) - n(H \cap F) - n(F \cap B) + n(B \cap H \cap F)$

Hence,

$n(B \cup H \cup F) = (21 + 26 + 29) - (14 + 15 + 12) + 8 = 43$

Thus these are 43 members in all.

27. 22

Sol. $n(M) = 55, n(P) = 67, n(M \cup P) = 100$

Now, $n(M \cup P) = n(M) + n(P) - n(M \cap P)$

$100 = 55 + 67 - n(M \cap P)$

$\therefore n(M \cap P) = 122 - 100 = 22$

Now n (P only) = $n(P) - n(M \cap P)$

$= 67 - 22 = 45$

28. 16

Sol. Given $n(N) = 12$, $n(P) = 16$, $n(H) = 18$,

$n(N \cup P \cup H) = 30$

From,

$n(N \cup P \cup H) = n(N) + n(P) + n(H) - n(N \cap P)$

$-n(P \cap H) - n(N \cap H) + n(N \cap P \cap H)$

$\therefore$ $n(N \cap P) + n(P \cap H) + n(N \cap H) = 16$

Now, number of pupils taking two subjects

$= n(N \cap P) + n(P \cap H) + n(N \cap H) - 3n(N \cap P \cap H)$

$= 16 - 0 = 16$.

29. 2

Sol. $n(A) = 4$, $n(B) = 3$

$n(A) \times n(B) \times n(C) = n(A \times B \times C)$

$4 \times 3 \times n(C) = 24 \Rightarrow n(C) = \frac{24}{12} = 2$

30. 8

Sol. Given set is $\{(a, b) : 2a^2 + 3b^2 = 35, a, b \in Z\}$

We can see that, $2(\pm 2)^2 + 3(\pm 3)^2 = 35$

and $2(\pm 4)^2 + 3(\pm 1)^2 = 35$

$\therefore$ (2, 3), (2, –3), (–2, –3), (–2, 3), (4, 1), (4, –1),
(–4, –1), (–4, 1) are 8 elements of the set.

$\therefore$ $n = 8$.