



A Premier Institute for Pre-Medical & Pre Engineering

**SRI VIDYA
ARADHANA
ACADEMY**
"Transforming Your DREAMS Into Reality...!"**NEET/JEE**

Topic: Sets

Mathematics

Assignment 06 • JEE Main PYQ (Sets & Venn Diagrams)

Chetan Sir

"Discipline today builds the rank you dream of tomorrow."

Subsets: an n -element set has 2^n subsets, $2^n - 1$ proper; $n(P(A)) = 2^n$. **Two sets:** $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.
Three sets: $n(A \cup B \cup C) = \sum n(A) - \sum n(A \cap B) + n(A \cap B \cap C)$. **De Morgan:** $(A \cup B)' = A' \cap B'$. **Overlap bound:**
 $\max(0, n(A) + n(B) - n(U)) \leq n(A \cap B) \leq \min(n(A), n(B))$.

SECTION A : SETS DEFINED BY A PROPERTY

- The number of elements in the set $\{n \in \mathbb{Z} : |n^2 - 10n + 19| < 6\}$ is _____. [JEE Main 2023]
- Let $X = \{n \in \mathbb{N} : 1 \leq n \leq 50\}$, let A be the multiples of 2 in X and B the multiples of 7 in X . The number of elements in the smallest subset of X containing both A and B is _____. [JEE Main 2020]
- The number of natural numbers n with $10 \leq n \leq 100$ for which $3^n - 3$ is a multiple of 7 is _____. [JEE Main 2023]
- In a class of 140 students numbered 1 to 140, all even-numbered students opted Mathematics, those whose number is divisible by 3 opted Physics, and those divisible by 5 opted Chemistry. The number of students who did not opt for any of the three courses is
(A) 42 (B) 102 (C) 1 (D) 38 [JEE Main 2019]
- Let A be the set of natural numbers from 100 to 700 (inclusive) that are neither multiples of 3 nor multiples of 4. The number of elements in A is
(A) 300 (B) 310 (C) 290 (D) 280 [JEE Main 2024]
- Let $A = \{n \in \mathbb{N} \mid n^2 \leq n + 10000\}$, $B = \{3k + 1 \mid k \in \mathbb{N}\}$ and $C = \{2k \mid k \in \mathbb{N}\}$. The sum of all the elements of $A \cap (B - C)$ is _____. [JEE Main 2021]
- Let $A = \{1, 2, 3, \dots, 10\}$ and let B be the set of all fractions $\frac{m}{n}$ with $m, n \in A$, $m < n$ and $\gcd(m, n) = 1$. Then $n(B)$ equals
(A) 29 (B) 31 (C) 37 (D) 36 [JEE Main 2025]
- Set A has m elements and set B has n elements. If the total number of subsets of A is 112 more than that of B , then $m \cdot n$ is _____. [JEE Main 2020]
- Let A and B be finite sets with m and n elements. The total number of subsets of A is 56 more than that of B . Then the distance of $P(m, n)$ from $Q(-2, -3)$ is
(A) 8 (B) 10 (C) 4 (D) 6 [JEE Main 2024]
- Let $A = \{1, 2, 3, 4, 5, 6, 7\}$ and $B = \{3, 6, 7, 9\}$. The number of sets C with $C \subseteq A$ and $C \cap B \neq \emptyset$ is _____. [JEE Main 2022]
- Let $X = \{1, 2, 3, 4, 5\}$. The number of ordered pairs (Y, Z) with $Y \subseteq X$, $Z \subseteq X$ and $Y \cap Z = \emptyset$ is
(A) 3^5 (B) 2^5 (C) 5^3 (D) 5^2 [JEE Main 2012]
- Let $A = \{1, 2, 3, 4, 5, 6, 7\}$. Let B be the collection of subsets T of A for which $1 \notin T$ or $2 \in T$, and C the collection of subsets T for which the sum of the elements of T is a prime number. The number of elements in $B \cup C$ is _____. [JEE Main 2022]
- For $n \geq 2$, let S_n be the set of all subsets of $\{1, 2, \dots, n\}$ containing no two consecutive numbers (e.g. $\{1, 3, 5\} \in S_6$ but $\{1, 2, 4\} \notin S_6$). Then $n(S_5)$ equals _____. [JEE Main 2025]
- Let $S = \{1, 2, \dots, 100\}$. The number of non-empty subsets A of S for which the product of the elements of A is even is
(A) $2^{50} - 1$ (B) $2^{50}(2^{50} - 1)$
(C) $2^{100} - 1$ (D) $2^{50} + 1$ [JEE Main 2019]
- Let S be the set of the first 11 natural numbers. The number of subsets B of S with $n(B) \geq 2$ for which

SECTION B : SUBSETS, POWER SET & COUNTING

the product of all elements of B is even is ____.

[JEE Main 2026]

SECTION C : OPERATIONS & ALGEBRA OF SETS

16. Let $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^n Y_i = T$, where each X_i has 10 elements and each Y_i has 5 elements. If each element of T belongs to exactly 20 of the X_i and exactly 6 of the Y_i , then n equals

(A) 30 (B) 50 (C) 15 (D) 45

[JEE Main 2020]

17. If A, B, C are three sets with $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then

(A) $A = C$ (B) $B = C$ (C) $A \cap B = \emptyset$ (D) $A = B$

[JEE Main 2009]

18. Let A, B, C be sets such that $\emptyset \neq A \cap B \subseteq C$. Then which statement is **not** true?

(A) If $(A - B) \subseteq C$, then $A \subseteq C$
 (B) $B \cap C \neq \emptyset$
 (C) $(C \cup A) \cap (C \cup B) = C$
 (D) If $(A - C) \subseteq B$, then $A \subseteq B$

[JEE Main 2019]

19. Let $P = \{\theta : \sin \theta - \cos \theta = \sqrt{2} \cos \theta\}$ and $Q = \{\theta : \sin \theta + \cos \theta = \sqrt{2} \sin \theta\}$. Then

(A) $P \subset Q$ and $Q - P = \emptyset$
 (B) $Q \subset P$
 (C) $P \subset Q$
 (D) $P = Q$

[JEE Main 2016]

20. Let A be the set of real m for which both roots of $x^2 - (m+1)x + m + 4 = 0$ are real, and $B = [-3, 5]$. Which is **not** true?

(A) $A \cap B = \{-3\}$
 (B) $B - A = (-3, 5)$
 (C) $A \cup B = \mathbb{R}$
 (D) $A - B = (-\infty, -3) \cup (5, \infty)$

[JEE Main 2020]

SECTION D : VENN DIAGRAMS & SURVEYS

21. Out of all patients in a hospital, 89% suffer from heart ailment and 98% from lungs infection. If $K\%$ suffer from both, then K **cannot** belong to

(A) $\{80, 83, 86, 89\}$ (B) $\{84, 86, 88, 90\}$
 (C) $\{79, 81, 83, 85\}$ (D) $\{84, 87, 90, 93\}$

[JEE Main 2021]

22. A survey shows 73% of an office likes coffee and 65% likes tea. If $x\%$ like both, then x **cannot** be

(A) 63 (B) 36 (C) 54 (D) 38

[JEE Main 2020]

23. A survey shows 63% read newspaper A and 76% read B . If $x\%$ read both, a possible value of x is

(A) 37 (B) 65 (C) 29 (D) 55

[JEE Main 2020]

24. An organization awarded 48 medals in event A , 25 in B and 18 in C . If these went to a total of 60 men with only 5 getting medals in all three events, the number receiving medals in exactly two events is

(A) 10 (B) 15 (C) 21 (D) 9

[JEE Main 2023]

25. Newspapers A, B are published in a city: 25% read A , 20% read B , 8% read both. Of those who read A but not B , 30% look at ads; of B but not A , 40%; of both, 50%. The % of the population looking at ads is

(A) 13.5 (B) 13 (C) 12.8 (D) 13.9

[JEE Main 2019]

26. In a survey of 220 students, at least 125 and at most 130 studied Mathematics; at least 85 and at most 95 Physics; at least 75 and at most 90 Chemistry; 30 studied Physics & Chemistry; 50 Chemistry & Mathematics; 40 Mathematics & Physics; and 10 studied none. If m, n are the least and most who studied all three, then $m + n$ is ____.

[JEE Main 2024]

ANSWER KEY

1. 6	2. 29	3. 15	4. D	5. A	6. 832
7. B	8. 28	9. B	10. 112	11. A	12. 107
13. 13	14. B	15. 1979	16. A	17. B	18. D
19. D	20. D	21. C	22. B	23. D	24. C
25. D	26. 45				