

The Volume Defence and Education Academy

NDA Mathematics

NDA Papers 2015 – 2023 | 15 Questions | Topic-wise Explanations

Previous Year Questions (PYQ)

Instructions: Each question has four options. The correct answer and detailed explanation are provided below each question.

Q1	In a group of 70 people, 37 like coffee, 52 like tea, and each person likes at least one. How many like both?	NDA 2022 I
Options	A) 15 B) 19 C) 22 D) 33	
Answer	B) 19	
Explanation	$n(C \cup T) = n(C) + n(T) - n(C \cap T)$. So $70 = 37 + 52 - n(C \cap T)$. Therefore $n(C \cap T) = 89 - 70 = 19$.	

Q2	If $A = \{1,2,3,4,5\}$, $B = \{2,4,6\}$, then $A \cap B$ is:	NDA 2021 II
Options	A) $\{1,3,5\}$ B) $\{2,4\}$ C) $\{1,2,3,4,5,6\}$ D) $\{6\}$	
Answer	B) $\{2,4\}$	
Explanation	$A \cap B$ contains elements common to both A and B. Common elements of $\{1,2,3,4,5\}$ and $\{2,4,6\}$ are 2 and 4.	

Q3	If $A = \{1,2,3\}$ and $B = \{3,4,5\}$, then $(A-B) \cup (B-A)$ equals:	NDA 2021 I
Options	A) $\{1,2,4,5\}$ B) $\{1,2,3,4,5\}$ C) $\{3\}$ D) $\{1,2\}$	
Answer	A) $\{1,2,4,5\}$	
Explanation	$A - B = \{1,2\}$, $B - A = \{4,5\}$. So $(A-B) \cup (B-A) = \{1,2,4,5\}$. This is the symmetric difference $A \Delta B$.	

Q4	If $n(A) = 20$, $n(B) = 15$, $n(A \cup B) = 30$, then $n(A \cap B)$ is:	NDA 2020 I
Options	A) 5 B) 10 C) 15 D) 35	
Answer	A) 5	
Explanation	By inclusion-exclusion: $30 = 20 + 15 - n(A \cap B)$. So $n(A \cap B) = 5$.	

Q5	If $(A \cup B)' = A' \cap B'$, this law is known as:	NDA 2019 II
Options	A) Distributive law B) Associative law C) De Morgan's law D) Commutative law	
Answer	C) De Morgan's law	
Explanation	$(A \cup B)' = A' \cap B'$ is De Morgan's first law. The complement of a union equals the intersection of complements.	

Q6	A set A has 4 elements. The number of subsets of A is:	NDA 2019 I
Options	A) 4 B) 8 C) 16 D) 32	
Answer	C) 16	
Explanation	Number of subsets = 2^n . Here $n = 4$, so $2^4 = 16$.	

Q7	In a class of 100 students: 60 play cricket, 50 play football, 30 play both. How many play neither?	NDA 2023 I
Options	A) 10 B) 20 C) 30 D) 40	
Answer	B) 20	
Explanation	$n(C \cup F) = 60 + 50 - 30 = 80$. Neither = $100 - 80 = 20$.	

Q8	Which of the following is a null set?	NDA 2022 II
Options	A) $\{x : x^2 = 9, x \text{ is even}\}$ B) $\{x : x + 5 = 5\}$ C) $\{x : x \text{ is prime}, 1 < x < 4\}$ D) $\{0\}$	
Answer	A) $\{x : x^2 = 9, x \text{ is even}\}$	
Explanation	$x^2 = 9$ gives $x = +/ -3$, neither is even. So this set is empty. Note: $\{x : x+5=5\} = \{0\}$ which has one element.	

Q9	If $A \subseteq B$, which of the following is always true?	NDA 2018 II
Options	A) $B \subseteq A$ B) $A \cap B = B$ C) $A \cup B = B$ D) $A = B$	
Answer	C) $A \cup B = B$	
Explanation	If $A \subseteq B$, then $A \cup B = B$, because all elements of A are already in B so the union adds nothing new.	

Q10	Set A has 3 elements and set B has 4 elements. The maximum number of elements in $A \cup B$ is:	NDA 2017 I
Options	A) 3 B) 4 C) 7 D) 12	
Answer	C) 7	
Explanation	Maximum $n(A \cup B)$ occurs when A and B are disjoint. Then $n(A \cup B) = 3 + 4 = 7$.	

Q11	If $n(A) = 5$, $n(B) = 6$ and $n(A \cap B) = 3$, then $n(A \Delta B)$ is:	NDA 2016 II
Options	A) 3 B) 5 C) 8 D) 11	
Answer	B) 5	
Explanation	$n(A \Delta B) = n(A) + n(B) - 2 \cdot n(A \cap B) = 5 + 6 - 6 = 5$.	

Q12	If $A = \{1,2,3,4,5,6\}$, $B = \{2,4,6,8\}$, then $n(A - B)$ is:	NDA 2022 I
Options	A) 2 B) 3 C) 4 D) 5	
Answer	B) 3	
Explanation	$A - B$ = elements in A not in B = $\{1,3,5\}$. So $n(A - B) = 3$.	

Q13	The symmetric difference $A \Delta B$ is defined as:	NDA 2018 I
Options	A) $A \cap B$ B) $A \cup B$ C) $(A-B) \cup (B-A)$ D) $A \times B$	
Answer	C) $(A-B) \cup (B-A)$	
Explanation	Symmetric difference $A \Delta B = (A-B) \cup (B-A)$. It contains elements in A or B but not both.	

Q14	$A \times B$ (Cartesian product) where $A = \{1,2\}$ and $B = \{a\}$ has how many elements?	NDA 2016 I
Options	A) 1 B) 2 C) 3 D) 4	
Answer	B) 2	
Explanation	$n(A \times B) = n(A) \times n(B) = 2 \times 1 = 2$. The pairs are (1,a) and (2,a).	

Q15	If $n(A) = 3$, the number of proper subsets of A is:	NDA 2015 II
Options	A) 6 B) 7 C) 8 D) 9	
Answer	B) 7	
Explanation	Total subsets = $2^3 = 8$. Proper subsets exclude the set itself: $8 - 1 = 7$.	

PART B — Key Formulas & Revision Notes

1. Inclusion-Exclusion Principle

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

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

$$n(\text{neither } A \text{ nor } B) = n(U) - n(A \cup B)$$

$$n(\text{only } A) = n(A) - n(A \cap B)$$

Tip: Always find $n(A \cup B)$ first, then subtract from total for 'neither' problems.

2. Subsets and Power Sets

$$\text{Total subsets of set } A = 2^{n(A)}$$

$$\text{Proper subsets} = 2^{n(A)} - 1$$

$$\text{Power set } P(A) \text{ has } 2^{n(A)} \text{ elements}$$

Tip: If $n(A) = 3 \rightarrow$ subsets = 8, proper subsets = 7, power set has 8 elements.

3. De Morgan's Laws

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

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

Tip: The complement of a union = intersection of complements. Most tested law in NDA!

4. Symmetric Difference

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

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

$$n(A \triangle B) = n(A) + n(B) - 2 \cdot n(A \cap B)$$

5. Cartesian Product

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

Tip: $A \times B \neq B \times A$ unless $A = B$.

6. Important Laws

$$\text{Commutative: } A \cup B = B \cup A \quad | \quad A \cap B = B \cap A$$

$$\text{Associative: } (A \cup B) \cup C = A \cup (B \cup C)$$

$$\text{Distributive: } A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

$$\text{Identity: } A \cup \emptyset = A \quad | \quad A \cap U = A$$

$$\text{Complement: } A \cup A' = U \quad | \quad A \cap A' = \emptyset$$

PART C — Common Mistakes to Avoid

Trap 1: $\{0\}$ is NOT an empty set

The set $\{0\}$ has one element (zero). The empty set $\emptyset$ has NO elements. This is a very common NDA trap.

Trap 2: Set difference is not commutative

$A - B \neq B - A$. Always check which set is being subtracted from which.

Trap 3: $\emptyset$ is a subset of every set

$\emptyset \subseteq A$ for any set A . So if $A = \{1,2,3\}$, $\emptyset$ is still one of its subsets — count it in the 2^n total.

Trap 4: Proper subset vs subset

$A \subseteq A$ (A is a subset of itself) but NOT a proper subset. Proper subsets = $2^n - 1$, not 2^n .

Trap 5: $n(A \cap B)$ cannot exceed $n(A)$ or $n(B)$

If your calculated $n(A \cap B)$ is greater than $n(A)$ or $n(B)$, your answer is wrong. Always self-check.

Trap 6: Equal vs Equivalent sets

Equal sets have the same elements. Equivalent sets only have the same number of elements. $\{1,2\}$ and $\{a,b\}$ are equivalent but not equal.