SET THEORY

◇ What is a Set?

A **set** is a **collection of distinct objects**. These objects are called **elements** or **members** of the set.

📌 Example:

Set A = {1, 2, 3, 4}
Here, 1, 2, 3, 4 are elements of set A.

◇ Set Notation

- **Curly brackets** {} are used to denote a set.
- ∈ means "is an element of"
  - Example: 2 ∈ A
- ∉ means "is not an element of"
  - Example: 5 ∉ A

◇ Types of Sets

Type	Example
Empty Set (∅)	A = {} or A = ∅
Finite Set	A = {1, 2, 3}
Infinite Set	N = {1, 2, 3, 4, ...}
Equal Sets	A = {1,2}, B = {2,1} ⇒ A = B
Subset (⊆)	A = {1,2}, B = {1,2,3} ⇒ A ⊆ B
Power Set	P(A) = all subsets of A
Universal Set (U)	Contains all elements under consideration

◇ Set Operations

1. **Union (∪)**
   - A ∪ B = elements in A or B or both
   - Example: A = {1, 2}, B = {2, 3} ⇒ A ∪ B = {1, 2, 3}
2. **Intersection (∩)**
   - A ∩ B = elements common to both A and B
   - A = {1, 2}, B = {2, 3} ⇒ A ∩ B = {2}
3. **Difference (–)**

- A – B = elements in A but not in B
- A = {1, 2}, B = {2, 3} ⇒ A – B = {1}

4. **Complement (A' or A^c)**
   - Elements not in A (from the Universal set)

◇ Venn Diagrams

Venn diagrams are used to visually represent sets and their relationships (like union, intersection, etc.).

◇ Important Laws

Law	Example
Commutative Law	A ∪ B = B ∪ A, A ∩ B = B ∩ A
Associative Law	A ∪ (B ∪ C) = (A ∪ B) ∪ C
Distributive Law	A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C)
De Morgan's Law	(A ∪ B)' = A' ∩ B', (A ∩ B)' = A' ∪ B'

◇ Cardinality

The number of elements in a set.
Example: A = {2, 4, 6} ⇒ |A| = 3

☑ **SET THEORY EXAMPLES**

1 Basic Set

Set A = {2, 4, 6, 8}
Elements: 2, 4, 6, 8
Here, 4 ∈ A and 5 ∉ A

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2 Empty Set (Null Set)

Set B = {} or ∅
→ A set with no elements.
Example: Set of students in class who are 200 years old.

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3 Subset (⊆)

A = {1, 2}
B = {1, 2, 3}
⇒ A ⊆ B ☑
⇒ B ⊆ A ❌

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4 Power Set

A = {x, y}
P(A) = {∅, {x}, {y}, {x, y}}
→ All possible subsets.

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5 Union (∪)

A = {1, 2, 3}
B = {3, 4, 5}
A ∪ B = {1, 2, 3, 4, 5}

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6 Intersection (∩)

A = {a, b, c}
B = {b, c, d}
A ∩ B = {b, c}

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7 Difference (–)

A = {10, 20, 30}
B = {20, 40}
A – B = {10, 30}
B – A = {40}

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8 Complement (A^c or A')

Universal Set U = {1, 2, 3, 4, 5}
A = {1, 2}
A^c = {3, 4, 5}

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9 Venn Diagram Example

Let:
A = {1, 2, 3}
B = {3, 4, 5}

- A ∪ B = {1, 2, 3, 4, 5}
- A ∩ B = {3}
- A – B = {1, 2}

🔟 Cardinality (|A|)

A = {apple, banana, mango}
|A| = 3 (because 3 elements)

☑ SET THEORY – MCQs (Multiple Choice Questions)

🧠 MCQs with Answers

1. What is the cardinality of the set A = {5, 10, 15, 20}?
A) 3
B) 4
C) 5
D) 2
☑ **Answer: B**

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2. If A = {1, 2, 3}, B = {3, 4, 5}, then A ∪ B = ?
A) {1, 2, 3, 4, 5}
B) {3}
C) {1, 2}
D) ∅
☑ **Answer: A**

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3. The intersection of two disjoint sets is:
A) Universal Set
B) Null Set (∅)
C) Infinite Set
D) Power Set
☑ **Answer: B**

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4. What is the power set of A = {x}?
A) ∅
B) {x, ∅}
C) {∅, {x}}
D) {{x}}
☑ **Answer: C**

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5. If U = {1,2,3,4,5} and A = {1,2}, then A′ = ?
A) {3, 4, 5}
B) {1, 2}
C) ∅
D) {1, 2, 3}
☑ **Answer: A**

📝 **PRACTICE PROBLEMS**

◇ **Problem 1:**

Let A = {2, 4, 6}, B = {4, 6, 8}.
Find:
a) A ∪ B
b) A ∩ B
c) A − B
☑ **Try it yourself first!**
Answer:
a) {2, 4, 6, 8}
b) {4, 6}
c) {2}

◇ **Problem 2:**

U = {a, b, c, d, e}, A = {a, c, d}
Find A′ (Complement of A)

☑ **Answer:**
A′ = {b, e}

◇ **Problem 3:**

Find the **power set** of:
A = {1, 2}

☑ **Answer:**
P(A) = {∅, {1}, {2}, {1, 2}}

◇ Problem 4:

If A = {1, 2, 3, 4}, B = {2, 4, 6}, find:
a) A ∪ B
b) A ∩ B
c) B − A

☑ Answer:
a) {1, 2, 3, 4, 6}
b) {2, 4}
c) {6}

🧠 SET THEORY – MCQs (Without Answers)

1. What is the cardinality of the set A = {10, 20, 30, 40, 50}?
A) 5
B) 10
C) 4
D) 0

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2. If A = {a, b, c}, B = {b, c, d}, then A ∪ B = ?
A) {a, b, c, d}
B) {b, c}
C) {a, d}
D) {a, b, c}

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3. What is the intersection of A = {1, 2, 3} and B = {3, 4, 5}?
A) {1, 2, 3, 4, 5}
B) {3}
C) {1, 2}
D) {5}

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4. Which of the following is the **power set** of A = {x, y}?
A) {x, y}
B) {∅, {x}, {y}, {x, y}}
C) {{x}, {y}}
D) {x, y, z}

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5. If U = {1, 2, 3, 4, 5}, A = {2, 4}, then A′ = ?
A) {1, 2, 3, 4, 5}
B) {1, 3, 5}

C) {2, 4}
D) {3, 4, 5}

✍️ PRACTICE PROBLEMS (No Answers)

◇ Problem 1:

Let A = {1, 3, 5}, B = {3, 4, 5, 6}.
Find:
a) A ∪ B
b) A ∩ B
c) A – B
d) B – A

◇ Problem 2:

Let U = {1, 2, 3, 4, 5, 6, 7}, A = {2, 4, 6}
Find the complement of A (A′)

◇ Problem 3:

A = {red, blue}, B = {blue, green}, C = {green, yellow}
Find:
a) A ∪ B
b) A ∩ B
c) (A ∪ B) ∩ C

◇ Problem 4:

Find the power set of A = {1, 2, 3}

◇ Problem 5:

If A = {2, 4, 6}, B = {1, 2, 3, 4, 5}, find:
a) A ∩ B
b) A ∪ B
c) B – A

🧠 MAH MCA CET – Set Theory MCQs (No Answers)

Q1. In a group of 60 students:

- 25 play cricket
- 20 play football
- 10 play both

How many students play **neither cricket nor football**?
A) 5
B) 15
C) 10
D) 20

Q2. Let A = {1, 2, 3, 4}, B = {3, 4, 5, 6}.

Find A ∩ B.
A) {1, 2}
B) {3, 4}
C) {5, 6}
D) {1, 2, 3, 4, 5, 6}

Q3. In a class of 50 students:

- 30 like Maths
- 25 like English
- 10 like both

How many students like **only Maths**?
A) 10
B) 20
C) 25
D) 15

Q4. If A and B are two sets such that |A| = 6, |B| = 4, and A ∩ B has 2 elements, then the number of elements in A ∪ B is:

A) 10
B) 8
C) 6
D) 12

Q5. Let U = {1 to 10}, A = {2, 4, 6, 8}, B = {3, 4, 5, 6}.

Find (A ∪ B)′
A) {1, 7, 9, 10}
B) {2, 3, 4, 5, 6, 8}

C) {1, 2, 3, 7}
D) {4, 5, 6, 7}

Q6. A survey shows:

- 80 people use WhatsApp
- 50 use Instagram
- 30 use both

How many people use **at least one** of them?
A) 100
B) 160
C) 80
D) 100

Q7. A = {x: x is an even number less than 10}, B = {2, 4, 6, 8, 10}

Then A ∩ B = ?
A) {10}
B) {2, 4, 6, 8}
C) ∅
D) {2, 4, 6, 8, 10}

🔁 **Instructions for Practice:**

- Try solving all questions **without calculator**.
- Draw **Venn diagrams** if the problem involves groups.
- Use the formula:
  n(A ∪ B) = n(A) + n(B) – n(A ∩ B)
  And for complements:
  n(U) = n(A ∪ B) + n(only A′ ∩ B′)
