# SETS: NOTES & EXAMPLES

## 1. Set Language and Notation

A **set** is a **well-defined collection of distinct objects**.

### *Common Notations:*

| Symbol | Meaning | Example |
|---|---|---|
| { } | A set | {2, 4, 6} |
| ∈ | "is an element of" | 4 ∈ {2, 4, 6} |
| ∉ | "is not an element of" | 5 ∉ {2, 4, 6} |
| ∅ | Empty set | ∅ = {} |
| n(A) | Number of elements in set A | If A = {1, 2, 3}, then n(A) = 3 |
| A′ | Complement of set A | Everything **not** in A |
| ⊆ | Subset | {1,2} ⊆ {1,2,3} |
| ∪ | Union (either A or B or both) | A ∪ B |
| ∩ | Intersection (both A and B) | A ∩ B |

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## 2. Types of Sets

| Type | Description | Example |
|---|---|---|
| Finite | Countable number of elements | {1, 2, 3} |
| Infinite | Uncountable elements | {x ∈ ℕ : x > 0} |
| Equal sets | Same elements | {1, 2, 3} = {3, 2, 1} |
| Subset | All elements of one set are in another | {1, 2} ⊆ {1, 2, 3} |
| Proper Subset | Subset but not equal | {1, 2} ⊂ {1, 2, 3} |
| Universal set (U) | All elements under consideration | U = {1,2,3,4,5,6} |
| Complement (A′) | Elements in U not in A | If A = {1,2}, A′ = {3,4,5,6} |

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## 3. Venn Diagrams

A **Venn diagram** visually represents sets and their relationships. Usually drawn with circles inside a rectangle (the **universal set**).

### *Venn Diagram Symbols:*

- Each **circle** = a set (e.g., A, B)
- **Overlapping area** = intersection
- **Non-overlapping area** = elements in one set only
- **Outside all circles** = elements not in any set (complement)

## 4. Examples

### *Example 1: Basic notation*

Let

A = {1, 2, 3, 4}

B = {3, 4, 5, 6}

Find:

- **A ∪ B** = {1, 2, 3, 4, 5, 6}
- **A ∩ B** = {3, 4}
- **A - B** = {1, 2} (in A but not in B)
- **B - A** = {5, 6}

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### *Example 2: Complement and Universal Set*

Let

U = {1, 2, 3, 4, 5, 6, 7, 8}

A = {2, 4, 6, 8}

Then

- **A′** = {1, 3, 5, 7} (everything in U not in A)
- **n(U)** = 8
- **n(A)** = 4
- **n(A′)** = 4

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### *Example 3: Three-set Venn Diagram*

Let:

- A = students who like Math
- B = students who like Science
- C = students who like English

You can use a three-circle Venn diagram to show:

- Students who like all 3 subjects → **A ∩ B ∩ C**
- Students who like only Math → **A ∩ B′ ∩ C′**
- Students who like Math and Science but not English → **A ∩ B ∩ C′**

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## 5. Set Identities You Should Know

| Identity | Meaning |
|---|---|
| A ∪ Ø = A | Union with empty set gives original set |
| A ∩ Ø = Ø | Nothing in common with empty set |

| Identity | Meaning |
| --- | --- |
| $A \cup A = A$ | Union with itself is itself |
| $A \cap A = A$ | Intersection with itself is itself |
| $A \cup A' = U$ | Set and its complement = universal set |
| $A \cap A' = \emptyset$ | No element common between a set and its complement |