📘 MATHS NOTEBOOK — RELATIONS & FUNCTIONS (Day 4)

Topic: Types of Relations + Equivalence Relation

🔵 1. Reflexive Relation

A relation **R** on a set **A** is *reflexive* if:

$$(a, a) \in R \quad \forall a \in A$$

Shortcut memory:

→ *Self-pair must be present.*

🔵 2. Symmetric Relation

A relation **R** on a set **A** is *symmetric* if:

$$(a, b) \in R \Rightarrow (b, a) \in R$$

Shortcut memory:

→ *Flip pair must also exist.*

🔵 3. Transitive Relation

A relation **R** on set **A** is *transitive* if:

$$(a, b) \in R \text{ and } (b, c) \in R \Rightarrow (a, c) \in R$$

Shortcut:

→ *Chain rule: if a→b and b→c, then a→c.*

🔵 4. Anti-symmetric Relation

A relation is **anti-symmetric** if:

$$(a, b) \in R \text{ and } (b, a) \in R \Rightarrow a = b$$

$(a, b) \in R$ and $(b, a) \in R$ $\Rightarrow a = b$

Shortcut:

→ *Two-way pairs allowed only if same element.*

Examples:

- ≤ (less than or equal to)
- ≥

🔵 5. Equivalence Relation

A relation is **equivalence** if it is:

✔ Reflexive
✔ Symmetric
✔ Transitive

This is extremely important for both boards & JEE.

🔵 6. Examples (Very Important)

Reflexive example

R = { (1,1), (2,2), (3,3) }

Symmetric example

R = { (1,2), (2,1) }

Transitive example

If (1,2) and (2,3) ∈ R, then (1,3) must be ∈ R.

Equivalence example

R = "has same remainder when divided by 4".

🔵 7. Ordered Pair Properties (Revision)

- (a, b) ≠ (b, a)

- Order matters
- Relation is subset of A × A

🔵 8. Domain, Codomain, Range (Quick Recall)

Domain → first elements

Range → actual second elements

Codomain → set of all possible second elements

🔵 9. Important NCERT Results

1. Identity relation is always reflexive, symmetric, transitive → equivalence.
2. Universal relation (A × A) is reflexive and symmetric, but not transitive.
3. Empty relation is symmetric and transitive, but *not reflexive*.

🔵 10. Formulas to Memorise (Today's 10 Formulas/Concepts)

1. Reflexive condition: $(a,a) \in R$
2. Symmetric: $(a,b) \rightarrow (b,a)$
3. Transitive: (a,b) & $(b,c) \rightarrow (a,c)$
4. Anti-symmetric: (a,b) & $(b,a) \rightarrow a=b$
5. Equivalence = R + S + T
6. Relation $\subseteq A \times A$
7. Cardinality of $A \times A = |A|^2$
8. Domain = set of first elements
9. Range = set of second elements
10. Identity relation = $\{ (a,a) \text{ for all } a \in A \}$