# Relations and Functions Class 12 Formula Sheet

CBSE Class 12 Maths · NCERT · for boards, NEET and JEE revision

ChapterNotes

## Types of Relations

| Type | Definition | Example |
|---|---|---|
| Empty Relation | No element of A is related to any element | R = {} on A |
| Universal Relation | Every element is related to every element | R = A × A |
| Reflexive | (a, a) ∈ R for all a ∈ A | "is equal to" on integers |
| Symmetric | If (a, b) ∈ R, then (b, a) ∈ R | "is a sibling of" |
| Transitive | If (a, b) ∈ R and (b, c) ∈ R, then (a, c) ∈ R | "is less than" |
| Equivalence Relation | Reflexive + Symmetric + Transitive | "is congruent to (mod n)" |

## Composition of Functions

$(g \circ f)(x) = g(f(x))$ - "g of f of x"

Read right to left: first apply f, then apply g

$g \circ f \neq f \circ g$ in general (not commutative)

$(g \circ f)$ is one-one if both f and g are one-one

$(g \circ f)$ is onto if both f and g are onto

## Inverse of a Function

$f^{-1}$ exists if and only if f is **bijective** (one-one AND onto)

$f^{-1}(y) = x$ where $f(x) = y$

$f \circ f^{-1} = I$ (identity function)

$f^{-1} \circ f = I$

## Types of Functions

**Number of functions from A to B:** $|B|^{|A|} = n(B)^{n(A)}$

**Number of one-one functions:** $P(n(B), n(A))$ if $n(B) \geq n(A)$, else 0

**Number of onto functions:** Uses inclusion-exclusion principle

| Type | Definition | Test |
|---|---|---|
| One-one (Injective) | $f(a_1) = f(a_2) \Rightarrow a_1 = a_2$ | Different inputs → different outputs |
| Onto (Surjective) | Range = Codomain | Every element in codomain has a pre-image |
| Bijective | Both one-one and onto | Invertible function |

## Binary Operations

A binary operation * on set A is a function from $A \times A \to A$

**Commutative:** $a * b = b * a$ for all a, b

**Associative:** $(a * b) * c = a * (b * c)$

**Identity element e:** $a * e = e * a = a$ for all a

**Inverse of a:** $a * b = b * a = e$

## Quick revision

- Equivalence = reflexive + symmetric + transitive
- Bijective = one-one + onto = invertible
- Composition: $g \circ f$ means apply f first, then g
- $f^{-1}$ exists $\iff$ f is bijective
- Binary operation: must be closed (result stays in the set)

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-maths/relations-and-functions-class-12-notes/