
□ Class 11 Mathematics – Chapter: Relations and Functions

1. Introduction

Relations and functions describe how elements from one set are associated with elements of another set. This is foundational in mathematics and used in algebra, calculus, and real-life applications.

---

2. Cartesian Product of Sets

- If A and B are two sets, then the Cartesian product A×BA \times BA×B is the set of all ordered pairs (a,b)(a, b)(a,b) where a□Aa \in Aa□A and b□Bb \in Bb□B.

- Example: If A={1,2}A = \{1, 2\}A={1,2} and B={x,y}B = \{x, y\}B={x,y}, then
  A×B={(1,x),(1,y),(2,x),(2,y)}A \times B = \{(1,x), (1,y), (2,x), (2,y)\}A×B={(1,x),(1,y),(2,x),(2,y)}

---

3. Relations

- A relation from set A to set B is any subset of the Cartesian product A×BA \times BA×B.
- A relation can be:
  - Empty
  - Universal
  - Identity
  - Inverse

- Reflexive, Symmetric, Transitive

---

4. Functions

- A function is a special relation in which each input (from set A) has a unique output (in set B).
- Notation: f:A□Bf : A \rightarrow Bf:A□B
- Each input has exactly one output.

---

5. Types of Functions

- One-one (Injective): Each element of the domain maps to a distinct element in the codomain.
- Onto (Surjective): Every element in the codomain is mapped by some element of the domain.
- Bijective: Both one-one and onto.
- Constant function: Same output for every input.
- Identity function: f(x)=xf(x) = xf(x)=x

---

6. Domain, Codomain, and Range

- Domain: Set of all inputs.
- Codomain: Set of all possible outputs.
- Range: Set of all actual outputs produced.

---

7. Real-Valued Functions of the Real Variable

Common examples include:

- Polynomial functions
- Rational functions

- Modulus function f(x)=∣x∣f(x) = |x|f(x)=∣x∣
- Greatest Integer Function f(x)=⌊x⌋f(x) = \lfloor x \rfloorf(x)=⌊x⌋
- Signum function
- Exponential & Logarithmic functions

---

8. Representation of Functions

- Arrow diagrams
-

Ordered pairs

- Tables
- Graphs
- Algebraic expression

---

9. Important Notes

- A function assigns exactly one output to each input.
- Graphical test: Vertical Line Test — If a vertical line cuts the graph more than once, it’s not a function.

- Relations may have multiple outputs for one input; functions cannot.

---

10. Applications

- Used in science, economics, and computing.
- Foundational for understanding calculus, graphs, and modeling real-world data.

---

11. Exam Tips

 Know definitions of relation, function, domain, and range
 Practice arrow diagrams and writing functions in set-builder notation
 Be able to identify function types (one-one, onto, etc.)

 Understand and graph key real-valued functions
 Solve problems involving composition of functions