

NCERT CHAPTER 2

Relations and Functions

Cartesian products, relations, functions, standard graphs, and finding Domain & Range.

🕒 Revision Time: 25 mins 🎯 Target: 5–7 Marks 📖 Textbook: [kcmh102.pdf](#)

⚡ Essential Formulas & Concept Summary

1. CARTESIAN PRODUCT & RELATIONS

For two non-empty sets A and B , $A \times B = \{(a, b) : a \in A, b \in B\}$.

$$\text{If } n(A) = p \text{ and } n(B) = q \implies n(A \times B) = pq$$

$$\text{Total number of relations from } A \text{ to } B = 2^{pq}$$

- **Domain of R :** Set of all first elements in the ordered pairs: $\{a \in A : (a, b) \in R\}$.
- **Range of R :** Set of all second elements in the ordered pairs: $\{b \in B : (a, b) \in R\}$.
- **Codomain:** The entire set B (Range $\subseteq$ Codomain).

2. DEFINITION OF A FUNCTION

A relation $f : A \rightarrow B$ is called a **function** if every element of A has exactly one image in B .

3. STANDARD REAL FUNCTIONS & PROPERTIES

- **Modulus Function:** $f(x) = |x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$ (Domain $= \mathbb{R}$, Range $= [0, \infty)$).
- **Signum Function:** $f(x) = \text{sgn}(x) = \begin{cases} 1, & x > 0 \\ 0, & x = 0 \\ -1, & x < 0 \end{cases}$ (Domain $= \mathbb{R}$, Range $= \{-1, 0, 1\}$).
- **Greatest Integer Function:** $f(x) = [x]$ (Domain $= \mathbb{R}$, Range $= \mathbb{Z}$).

4. GOLDEN RULES FOR DOMAIN & RANGE

$$\text{Fraction } \frac{P(x)}{Q(x)}: \quad Q(x) \neq 0$$

$$\text{Square root } \sqrt{g(x)}: \quad g(x) \geq 0$$

$$\text{Root in denominator } \frac{1}{\sqrt{g(x)}}: \quad g(x) > 0$$

$$f(x) = \sqrt{a^2 - x^2}: \quad \text{Domain} = [-a, a], \quad \text{Range} = [0, a]$$

🎯 Top Expected Exam Questions (Step-by-Step Solutions)

Question 1: Domain and Range of Radical Function

3–4 Marks

Find the domain and range of the real-valued function:

$$f(x) = \sqrt{16 - x^2}$$

Question 2: Finding Linear Function Coefficients

2–3 Marks

Let $f = \{(1, 1), (2, 3), (0, -1), (-1, -3)\}$ be a function from $\mathbb{Z}$ to $\mathbb{Z}$ defined by $f(x) = ax + b$. Determine a and b .

⚠ Exam Traps & Silly Mistakes**⚠ Trap 1: Incorrect Range of $\sqrt{a^2 - x^2}$**

Never write the range as $[-a, a]$. By definition, $\sqrt{z} \geq 0$. The range of $\sqrt{16 - x^2}$ is $[0, 4]$.

⚠ Trap 2: Canceling Factors Before Finding Domain

In rational functions like $\frac{x^2 - 1}{x - 1}$, find domain first ($x \neq 1$) before simplifying to $x + 1$.

☑ Quick Self-Check

Quiz 1: If $A = \{1, 2\}$ and $B = \{3, 4, 5\}$, how many relations can be defined from A to B ?

Quiz 2: What is $[-3.2]$ under the Greatest Integer Function?