Class 12 Maths Chapter 1: Relations and Functions - Notes, Important Questions and MCQs (2026-27)

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These Class 12 Maths Chapter 1 notes cover “Relations and Functions” from the NCERT Mathematics Part I textbook (2026-27): types of relations – empty, universal, reflexive, symmetric, transitive and equivalence relations – equivalence classes, and types of functions – one-one (injective), onto (surjective) and bijective – with tables, solved examples, Q&A, 10 MCQs and a free PDF.

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Chapter Overview

A relation R from a set A to a set B is a subset of A × B. A relation on a set A is a subset of A × A. Relations are classified by properties such as reflexivity, symmetry and transitivity; a relation having all three is an equivalence relation.

A function f : A → B assigns each element of A exactly one element of B. Functions are classified as one-one (distinct inputs give distinct outputs), onto (every element of B is an image) or bijective (both). These ideas lead to invertibility, which is used in later chapters.

Important Topics and Concepts

Types of Relations

- Empty relation: $R = \varphi \subset A \times A$ – no element is related.
- Universal relation: $R = A \times A$ – every element is related to every element.
- Reflexive: $(a, a) \in R$ for every $a \in A$.
- Symmetric: $(a, b) \in R \Rightarrow (b, a) \in R$.
- Transitive: $(a, b) \in R$ and $(b, c) \in R \Rightarrow (a, c) \in R$.

Equivalence Relation and Classes

- A relation that is reflexive, symmetric and transitive is an equivalence relation.
- Example: $R = \{(a, b) : a - b$ is divisible by $3\}$ on Z is an equivalence relation.
- An equivalence relation divides A into disjoint subsets called equivalence classes; $[a] = \{x \in A : (x, a) \in R\}$.
- Equivalence classes are pairwise disjoint and their union is A.

Types of Functions

- One-one (injective): $f(x_1) = f(x_2) \Rightarrow x_1 = x_2$.
- Many-one: two or more elements have the same image.
- Onto (surjective): every $y \in B$ has some $x \in A$ with $f(x) = y$ (range = co-domain).
- Into: range is a proper subset of co-domain.
- Bijective: both one-one and onto.

Testing Functions

- To test one-one: assume $f(x_1) = f(x_2)$ and show $x_1 = x_2$.
- Graph test: a horizontal line cuts the graph at most once for a one-one function.
- To test onto: take any y in the co-domain, solve $y = f(x)$ and check x lies in the domain.
- Example: $f : R \to R$, $f(x) = 2x + 3$ is bijective; $f(x) = x^2$ on R is neither one-one nor onto.

Counting Results

- If $n(A) = m$ and $n(B) = n$, number of relations from A to B = 2^(mn).
- Number of relations on A with n elements = $2^{(n^2)}$.
- Number of functions from A to B = n^m.
- Number of one-one functions from A to B ($m \leq n$) = ${}^nP_m$.
- Number of bijections on a set of n elements = n!.

Solved Examples

Board-pattern practice.

- Show $R = \{(a, b): |a - b|$ is even$\}$ on $\{1, 2, 3, 4, 5\}$ is an equivalence relation. $|a - a| = 0$ even (reflexive); $|a - b| = |b - a|$ (symmetric); if $a - b$ and $b - c$ are even, $a - c = (a - b) + (b - c)$ is even (transitive).
- Is $f : N \to N$, $f(x) = x^2$ one-one? Yes – $x_1^2 = x_2^2 \Rightarrow x_1 = x_2$ for natural numbers. Not onto, as 2 has no pre-image.
- Number of relations on a set with 3 elements? $2^9 = 512$.
- Is $f : R \to R$, $f(x) = 3 - 4x$ bijective? One-one: $3 - 4x_1 = 3 - 4x_2 \Rightarrow x_1 = x_2$. Onto: $x = (3 - y)/4 \in R$. Hence bijective.

Types of Relations at a Glance

Relation	Condition	Example on Z
Reflexive	$(a, a) \in R\ \forall\ a$	$a \leq b$
Symmetric	$(a, b) \in R \Rightarrow (b, a) \in R$	$a - b$ is even
Transitive	$(a, b), (b, c) \in R \Rightarrow (a, c) \in R$	$a < b$
Equivalence	All three	$a \equiv b \pmod{n}$

Important Definitions and Terms

Term	Meaning
Relation	Subset of $A \times B$
Empty relation	No element related; $R = \varphi$
Universal relation	$R = A \times A$
Reflexive	Every element related to itself
Symmetric	$aRb \Rightarrow bRa$
Transitive	$aRb, bRc \Rightarrow aRc$
Equivalence class	Set of elements related to a given element
One-one function	Distinct elements have distinct images
Onto function	Range equals co-domain
Bijective function	Both one-one and onto

Short Answer Questions

Q1. Define an equivalence relation.

A relation that is reflexive, symmetric and transitive.

Q2. What is an empty relation?

A relation in which no element of A is related to any element of A, i.e. $R = \varphi$.

Q3. Give an example of a relation that is symmetric but not transitive.

On $\{1, 2, 3\}$, $R = \{(1, 2), (2, 1)\}$ – $(1, 1)$ is missing, so not transitive.

Q4. When is a function onto?

When every element of the co-domain has a pre-image, i.e. range = co-domain.

Q5. Is $f(x) = x^2$ from R to R one-one?

No, since $f(-1) = f(1) = 1$.

Q6. How many functions are there from a set of 2 elements to a set of 3 elements?

$3^2 = 9$.

Q7. What is a bijective function?

A function that is both one-one and onto.

$2^{(n^2)}$.

Long Answer Questions

Q1. Show that R = {(a, b): a – b is divisible by 5} on Z is an equivalence relation.

Reflexive: a – a = 0 is divisible by 5.

Symmetric: if 5 | (a – b) then 5 | (b – a).

Transitive: a – c = (a – b) + (b – c) is divisible by 5.

Hence R is an equivalence relation.

Equivalence classes: [0], [1], [2], [3], [4].

Q2. Show that f : R → R, f(x) = 2x – 5 is bijective.

Let $f(x_1) = f(x_2)$: $2x_1 – 5 = 2x_2 – 5 \Rightarrow x_1 = x_2$ – one-one.

Let $y \in R$; solve $y = 2x – 5 \Rightarrow x = (y + 5)/2 \in R$.

$f((y + 5)/2) = y$ – onto.

Hence bijective.

So f is invertible.

Q3. Explain the types of functions with examples.

One-one: f(x) = 3x on R.

Many-one: $f(x) = x^2$ on R.

Onto: $f(x) = x^3$ on R.

Into: $f(x) = x^2$ from R to R.

Bijective: f(x) = x + 1 on R.

MCQs with Answers

1. A relation on A that is reflexive, symmetric and transitive is(a) empty (b) universal only (c) equivalence (d) identity onlyAnswer: (c) equivalence

2. Number of relations on a set with 2 elements(a) 4 (b) 8 (c) 16 (d) 2Answer: (c) 16

3. f : R → R, $f(x) = x^2$ is(a) one-one (b) onto (c) neither one-one nor onto (d) bijectiveAnswer: (c) neither one-one nor onto

4. Number of bijections on a set of 4 elements(a) 4 (b) 16 (c) 24 (d) 256Answer: (c) 24

5. R = A × A is(a) empty relation (b) universal relation (c) identity relation (d) inverse relationAnswer: (b) universal relation

6. $f(x_1) = f(x_2) \Rightarrow x_1 = x_2$ means f is(a) onto (b) one-one (c) into (d) constantAnswer: (b) one-one

7. Range = co-domain means f is(a) one-one (b) onto (c) many-one (d) intoAnswer: (b) onto

8. Number of functions from a 3-element set to a 2-element set(a) 6 (b) 8 (c) 9 (d) 5Answer: (b) 8

10. “Is less than” on R is(a) reflexive (b) symmetric (c) transitive (d) equivalenceAnswer: (c) transitive

Quick Revision Points

- Relation ⊂ A × B.
- Empty, universal, reflexive, symmetric, transitive.
- Equivalence relation and classes.
- One-one, onto, bijective tests.
- Counting: 2^(mn), n^m, n!.
- Horizontal line test.

Chapter Summary

A relation on a set A is a subset of A × A. It may be empty, universal, reflexive, symmetric or transitive, and a relation with the last three properties is an equivalence relation that partitions the set into disjoint equivalence classes.

A function assigns each input exactly one output. It is one-one if distinct inputs have distinct images, onto if every co-domain element has a pre-image, and bijective if both – which makes it invertible.

Exam Tips and PYQ Pattern

- Always check all three properties for equivalence.
- Show both one-one and onto steps for bijective.
- Give counter-examples to disprove properties.
- Use the counting formulas for MCQs.
- Write the domain and co-domain clearly.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 12 Mathematics Part I textbook, prescribed in the CBSE 2026-27 syllabus.

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Yes. Use the free PDF link at the top of this page – no signup needed.

What is an equivalence relation?

A relation that is reflexive, symmetric and transitive.

How do you prove a function is bijective?

Show it is one-one ($f(x_1) = f(x_2) \Rightarrow x_1 = x_2$) and onto (every y in the co-domain has a pre-image).

Conclusion

Relations and Functions builds the language for the whole course. Practise the proofs here and save the free PDF.

More Notes: Class 12 Maths Chapter 2: Inverse Trigonometric Functions notes | All Class 12 Maths notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE maths educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 12 Maths textbook, Mathematics Part I (NCERT reprint 2026-27, rationalised syllabus), and the CBSE syllabus for the 2026-27 session. Last checked on 26 November 2026.