

Relations and Functions — CBSE Pattern Test 1

Class 12 Maths · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 1 — CBSE Pattern (90 minutes, 40 marks)

Class 12 Maths · Relations and Functions · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.
 (2) All questions are compulsory. No overall choice is given; internal choice, where allowed, is clearly marked.
 (3) For MCQ questions choose the single correct option; for VSA answers write a single line.
 (4) Take $g = 10 \text{ m/s}^2$. All symbols carry their usual meaning. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

1. A relation R on a set A is reflexive if
 - (A) $(a, a) \in R$ for all $a \in A$
 - (B) $(a, b) \in R \implies (b, a) \in R$
 - (C) $(a, b), (b, c) \in R \implies (a, c) \in R$
 - (D) $R = A \times A$
2. A relation R is symmetric if
 - (A) $(a, b) \in R \implies (b, a) \in R$
 - (B) $(a, a) \in R$
 - (C) $(a, b), (b, c) \in R \implies (a, c) \in R$
 - (D) $R = A \times A$
3. A relation that is reflexive, symmetric and transitive is called
 - (A) an equivalence relation
 - (B) a function
 - (C) a partial order
 - (D) an empty relation
4. A function $f : A \rightarrow B$ is one-one (injective) if
 - (A) distinct elements of A have distinct images
 - (B) every element of B has a pre-image
 - (C) f is constant
 - (D) $A = B$
5. A function that is both one-one and onto is called
 - (A) bijective
 - (B) injective only
 - (C) surjective only
 - (D) constant
6. The composition $(f \circ g)(x)$ means
 - (A) $f(g(x))$
 - (B) $g(f(x))$
 - (C) $f(x) \circ g(x)$
 - (D) $f(x) + g(x)$
7. A function f is invertible if it is
 - (A) bijective

- (B) injective only
 (C) surjective only
 (D) constant
8. A binary operation $*$ on a set A is commutative if
 (A) $a * b = b * a$
 (B) $a * (b * c) = (a * b) * c$
 (C) $a * e = a$
 (D) $a * a = a$
9. Define a reflexive relation.
10. Define a one-one function.

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Define a symmetric relation.
12. What is an equivalence relation?
13. When is a function invertible?
14. What is an identity element for a binary operation?

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Check whether $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = 2x$ is one-one and onto.
16. If $f(x) = x + 2$ and $g(x) = 3x$, find $(f \circ g)(x)$.
17. Find the inverse of $f(x) = 2x + 3$.
18. Check whether the operation $a * b = a + b - 2$ on integers is commutative.

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. Show that the relation R on the set of integers defined by $R = \{(a, b) : a - b \text{ is divisible by } 5\}$ is an equivalence relation.
20. Show that $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2$ is neither one-one nor onto. Find the identity element for the operation $a * b = a + b - 2$ on integers.

Answer Key (Marking Scheme)

- Q1 — (A) $(a, a) \in R$ for all $a \in A$. Q2 — (A) $(a, b) \in R \implies (b, a) \in R$. Q3 — (A) an equivalence relation. Q4 — (A) distinct elements of A have distinct images.
- Q5 — (A) bijective. Q6 — (A) $f(g(x))$. Q7 — (A) bijective. Q8 — (A) $a * b = b * a$.
- Q9 — $(a, a) \in R$ for all $a \in A$.
- Q10 — Distinct inputs have distinct images.
- Q11 — $(a, b) \in R \implies (b, a) \in R$.
- Q12 — Reflexive, symmetric and transitive.
- Q13 — When it is bijective.
- Q14 — An element e with $a * e = e * a = a$.
- Q15 — One-one and onto.
- Q16 — $3x + 2$.
- Q17 — $(x - 3)/2$.

Q18 — Commutative.

Q19 — Reflexive, symmetric and transitive.

Q20 — Not one-one (-2 and 2 give 4), not onto (negatives have no pre-image); identity $e = 2$.