CBSE ACADEMY PLUS

Unit 1

Relations & Functions

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. If $R = \{(x, y): x, y \in Z, x^2 + y^2 \leq 4\}$ is a relation is set Z, then domain of R is
(a) {0, 1, 2} (b) {–2, –1, 0, 1, 2} (c) {0, –1, –2} (d) {–1, 0, 1}

2. Let the relation R in the set $A = \{x \in Z : 0 \leq x \leq 12\}$, given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$. Then [1], the equivalence class containing 1, is :
(a) {1, 5, 9} (b) {0, 1, 2, 5} (c) ϕ (d) A

3. Given triangles with sides T_1 : 3, 4, 5; T_2 : 5, 12, 13; T_3 : 6, 8, 10; T_4 : 4, 7, 9 and a relation R in set of triangles defined as $R = \{(\Delta_1, \Delta_2) : \Delta_1 \text{ is similar to } \Delta_2\}$. Which triangles belong to the same equivalence class?
(a) T_1 and T_2 (b) T_2 and T_3 (c) T_1 and T_3 (d) T_1 and T_4

4. A relation R in set A = {1, 2, 3} is defined as R = {(1, 1), (1, 2), (2, 2), (3, 3)}. Which of the following ordered pair in R shall be removed to make it an equivalence relation in A?
(a) (1, 1) (b) (1, 2) (c) (2, 2) (d) (3, 3)

5. Given set A = {1, 2, 3} and a relation R = {(1, 2), (2, 1)}, the relation R will be
(a) reflexive if (1, 1) is added (b) symmetric if (2, 3) is added
(c) transitive if (1, 1) is added (d) symmetric if (3, 2) is added

6. Let 'f' : R – {2} → R – {1} be a function defined by $f(x) = \frac{x-1}{x-2}$, then 'f' is
(a) into function (b) many one function
(c) bijective function (d) many one, into function.

7. Let the function 'f' : N → N be defined by f(x) = 2x + 3, x ∈ N. Then 'f' is
(a) not onto (b) bijective function
(c) many-one, into function (d) None of these

8. Set A has 3 elements and the set B has 4 elements. Then the number of injective functions that can be defined from set A to set B is
(a) 144 (b) 12 (c) 24 (d) 64

For Q9 and Q10, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

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9. **Assertion (A):** Given set A = {1, 2, 3, ... 9} and relation R in set A × A defined by (a, b) R (c, d) if a + d = b + c, be an equivalence relation. The ordered pair (1, 3) belongs to equivalence class related to [(5, 3)]
Reason (R): Any ordered pair of A × A belongs to equivalence class [(5, 3)] if (x, y) R (5, 3) ∀ (x, y) ∈ A × A.

10. **Assertion (A):** Let R be the relation on the set of integers Z given by R = {(a, b) : 2 divides (a - b)} is an equivalence relation.
Reason (R): A relation R in a set A is said to be an equivalence relation if R is reflexive, symmetric and transitive.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Check whether the relation R defined in the set {1, 2, 3, 4, 5, 6} as $R = \{(a, b) : b = a + 1\}$ is reflexive, symmetric or transitive.

12. Write the inverse relation corresponding to the relation R given by R = {(x, y): x ∈ N, x < 5, y = 3}. Also write the domain and range of inverse relation.

13. Show that the relation S in the set R of real numbers, defined as $S = \{(a, b) : a, b \in R \text{ and } a \leq b^2\}$ is neither reflexive, nor symmetric, nor transitive.

14. Let f : N → N be defined by

$$f(x) = \begin{cases} \frac{n+1}{2}, \text{if n is odd} \\ \frac{n}{2}, \text{if n is even} \end{cases}$$

For all n ∈ N, state whether the function f is bijective. Justify your answer.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Show that the modulus function f : R → R given by f (x) = |x|, is neither one-one nor onto, where |x| is x, if x is positive or 0 and |x| is –x, if x is negative.

16. Given a non-empty set X, define the relation R in P(X) as follows:
For A, B ∈ $P(X)$, $(A, B) \in R$ iff $A \subset B$. Prove that R is reflexive, transitive and not symmetric.

17. Check whether the relation R defined on the set A = {1, 2, 3, 4, 5, 6} as R = {(a, b) : b = a + 1} is reflexive, symmetric or transitive.

SECTION – D

Questions 18 carry 5 marks.

18. Show that each of the relation R in the set $A = \{x \in Z : 0 \leq x \leq 12\}$, given by R = {(a, b): |a – b| is a multiple of 4} is an equivalence relation. Find the set of all elements related to 1.

OR

Show that the function $f : R \to \{x \in R : -1 < x < 1\}$ defined by $f(x) = \frac{x}{1+|x|}, x \in R$ is one-one and onto function.

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SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. An organization conducted bike race under two different categories-Boys and Girls. There were 28 participants in all. Among all of them, finally three from category 1 and two from category 2 were selected for the final race. Ravi forms two sets B and G with these participants for his college project. Let B = $\{b_1, b_2, b_3\}$ and G = $\{g_1, g_2\}$, where B represents the set of Boys selected and G the set of Girls selected for the final race.

Based on the above information, answer the following questions:

(i) How many relations are possible from B to G ? (1)

(ii) Among all the possible relations from B to G, how many functions can be formed from B to G ? (1)

(iii) Let R : B → B be defined by R = {(x, y) : x and y are students of the same sex}. Check if R is an equivalence relation. (2)

OR

(iii) A function f : B → G be defined by f = $\{(b_1, g_1), (b_2, g_2), (b_3, g_1)\}$.
Check iff is bijective. Justify your answer. (2)

20. Students of Grade 9, planned to plant saplings along straight lines, parallel to each other to one side of the playground ensuring that they had enough play area. Let us assume that they planted one of the rows of the saplings along the line y = x – 4. Let L be the set of all lines which are parallel on the ground and R be a relation on L.

(i) Let relation R be defined by R = $\{(L_1, L_2): L_1 \parallel L_2$ where $L_1, L_2 \in L\}$. What is the type of relation R? (2)

(ii) (a) Check whether the function f : R → R defined by f(x) = x – 4 is bijective or not. (2)

OR

(ii) (b) Let f : R → R be defined by f(x) = x + 4. Find the range of f{x). (2)

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