CBSE Class 12 Maths 2024-25

Chapter 1 Relations and Functions

Competency-Based Questions

Multiple Choice Questions :

Q1. Given below is a relation R from the set X = { x,y,z } to itself.

R = {(x, x), (x,y), (y, x), (y,z), (x, z)}

Which of the following is true about the relation R?

1. R is reflexive and transitive but not symmetric.

2. R is symmetric and transitive but not reflexive.

3. R is transitive but neither reflexive nor symmetric.

4. R is not reflexive, not symmetric and not transitive.

Ans. 4. R is not reflexive, not symmetric and not transitive.

Q2. A and B are two sets with m elements and n elements respectively (m < n).

How many onto functions can be defined from set A to B?

1. 0

2. m!

3. n!

4. n^m

Ans. 1. 0

Q3. Three students Aabha, Bhakti and Chirag were asked to define a function, f, from set X = {1, 3, 5, 7, 9} to set Y = {2, 4, 6, 8}. Their responses are shown below:

Aabha: f = {(1, 2), (1, 4), (1, 6), (1, 8)}

Bhakti: f= {(1, 2), (3, 4), (5, 6), (7, 8)}

Chirag: f = {(1, 4), (3, 4), (5, 4), (7, 4), (9, 4)}

Who defined a function correctly?

1. only Chirag

2. only Aabha and Bhakti

3. only Bhakti and Chirag

4. only Chirag and Aabha

Ans. 1. only Chirag

Q4. Which of the following is an equivalence relation on the set P = {1, 4, 9}?

1. R^1 = {(1, 1), (4, 4), (9, 9)}

2. R^2 = {(1, 1), (4, 4), (1, 4), (4, 1)}

3. R^3 = {(4, 4), (9, 9), (1, 1), (9, 1), (1, 9), (1, 4), (4, 1)}

4. R^4 = {(1, 4), (4, 4), (9, 4), (4, 1), (1, 1), (9, 9), (9, 1)}

Ans. 1. R^1 = {(1, 1), (4, 4), (9, 9)}

Q5. The power set of a set A = { a, b } is the set of all subsets of A. These subsets are given by:

P(A) = { ∅, { a }, { b }, { a, b } }

A relation R is defined on P(A) as R = { (r, s) : r ⊆ s }

Which of the following is the correct representation of R in its roster form?

1. { ∅, { a }, { b }, { a, b } }

2. { (∅, { a }), (∅, { b }), (∅, { a, b }) }

3. { (∅, { a }), (∅, { b }), (∅, { a, b }), ({ a }, { a, b }), ({ b }, { a, b }) }

4. { (∅, { a }), (∅, { b }), (∅, { a, b }), ({ a }, { a, b }), ({ b }, { a, b }), ({ a, b }, { a, b }) }

Ans. 4. { (∅, { a }), (∅, { b }), (∅, { a, b }), ({ a }, { a, b }), ({ b }, { a, b }), ({ a, b }, { a, b }) }

Q6. Consider an operation * defined on the set { a,b,c } given by the following operation table.

*	a	b	c
a	a	a	a
b	a	a	a
c	a	a	a

Which of the following is true about the operation *?

1. * is not a binary operation

2. * is a binary operation that is commutative but not associative

3. * is a binary operation that is associative but not commutative

4. * is a binary operation that is both commutative and associative

Ans. 4. * is a binary operation that is both commutative and associative

Q7. If f (x) = x^3 + 1 and f (g(x)) = x, then which of the following is g (1)?

1. 0

2. 1

3. 2

4. (cannot be determined without knowing what is g (x))

Ans. 1. 0

Q8. A relation R on set G = {All the students in a certain mathematics class} is defined as, R = {(x, y): x and y have the same mathematics teacher}.

Which of the following is true about R?

1. R is reflexive and transitive but not symmetric.

2. R is transitive and symmetric but not reflexive.

3. R is reflexive and symmetric but not transitive.

4. R is an equivalence relation.

Ans. 4. R is an equivalence relation.

Assertion & Reason Type Question :

Q9. f: X-> X is a function on the finite set X.

Given below are two statements based on the above context - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).

Assertion (A): If f is onto, then f is one-one and if f is one-one, then f is onto.

Reason (R): Every one-one function is always onto and every onto function is always one-one.

1. Both (A) and (R) are true and (R) is the correct explanation for (A).

2. Both (A) and (R) are true but (R) is not the correct explanation for (A).

3. (A) is true but (R) is false.

4. Both (A) and (R) are false.

Ans. 3. (A) is true but (R) is false.

Free Response Questions :

Q10. State whether the following statement is true or false. Justify your answer.

"The sine function is bijective in nature when the domain is set from 0 to 4π."

Ans. Writes False (F)

Writes that the sine function is onto but not one-one (gives an example such as sin(π/2) = sin(5π/2) = 1), therefore it is not bijective in nature.

Q11. State whether the following statement is true or false. Justify your answer.

"A function f(x) = In x is invertible for all values of x ."

Ans. Writes True (T)

Writes that the logarithmic function is both onto and one-one. Hence, its inverse exists.

(Award full marks for any other logical explanation.)

Q12. A = {1, 3, 5, 7, ...}

B = {2, 4, 6, 8, ...}

Define a function from A to B that is neither one-one nor onto.

Ans. Defines a function from A to B that is neither one-one nor onto. For example, f: A-> B defined by f(x) = 4 for all x E A.

Q13. X and Y are two sets with their number of elements being k and I respectively (k < 1), Find the number of onto functions that can be defined from set X to Y. Explain your answer.

Ans. Writes that the number of onto functions from set X to Y is zero.

Reasons that, since set Y contains more elements than set X, at least one element of Y will always remain unmapped.

Q14. Shreyas and Simran are playing a game in which they are trying to guess relations on set A = {-2, -3}. Simran tells Shreyas that she is thinking of an equivalence relation.

Shreyas guesses the relation as R = {(-2, -3), (-3, -2), (-3, -3)} .

Could Shreyas be correct? Justify your answer.

Ans. Writes that Shreyas is not correct.

Writes that Shreyas' relation is not reflexive as (-2, -2) is not a part of it.

Writes that, since the relation is not reflexive, it cannot be an equivalence relation.

Q15. Let f : A → B and g : B → C be two functions.

(i) If f is not one-one, can g of be one-one?

(ii) If f is not onto, can go f be onto?

Justify your answer.

Ans.

(i) Writes that go f cannot be one-one, since g of is one-one implies f is one-one.

(ii) Writes that g of can be onto, since g of is onto implies g is onto and there is no restriction on f to be one-one or onto.

Q16. Express the relation R in roster form.

Ans. Expresses the relation R in roster form as R = {(D, S), (D, C), (D, K), (S, C), (S, K), (C, K)}.

Q17. Is R a reflexive relation? Justify your answer.

Ans. Writes yes.

Justifies the answer. For example, the cost of every chocolate is equal to its own cost i.e. (x,x) ∈ R, for every x ∈ A.

Q18. Is R a symmetric relation? Justify your answer.

Ans. Writes no.

Justifies the answer. For example, (D, S) E R but (S, D) R. Hence, R is not symmetric.

Q19. Is R a transitive relation? Justify your answer.

Ans. Writes yes.

Justifies the answer. For example:

Let (x, y) and (y,z) ER

=> cost of x ≤ cost of y and cost of y ≤ cost of z

Uses the above set of inequalities to show that cost of x ≤ cost of z. Hence, concludes that (x, z) ∈ R.

Q20. Define a function from set A to set B.

Ans. Defines a function from set A to set B. For example:

f: A -> B, defined by, f (x) = cost of x.

(Award full marks if any function is written correctly in set-builder form or in roster form.)