Maxprap. Chapter wise Series Class 12^{th} – Relation and Function

Class : 12^{th} **Subject: Mathematics**

Max. Marks : 70 **Duration : 2½ Hrs**

Sections: A (MCQs), B (Short Answer-I), C (Short Answer-II), D (Long Answer), E (Case-Based).

General Instructions:

(i). All questions are compulsory.

(ii). This question paper contains 30 questions divided into five Sections A, B, C, D and E. (iii). Section A comprises of 10 MCQs of 1 mark each. Section B comprises of 10 questions of 2 marks each. Section C comprises of 4 questions of 3 marks each. Section D comprises of 4 question of 5 marks each and Section E comprises of 2 Case Study Based Questions of 4 marks each.

(iv). There is no overall choice.

(v). Use of Calculators is not permitted.

Section A

Questions 1 to 10 carry 1 mark each

1. Let A = {1, 2, 3}, then the relation R = {(1, 1), (1, 2), (2, 1)} on A is

a) reflexive b) symmetric c) transitive d) Asymmetric

2. Let L denote the set of all straight lines in a plane. Let a relation R be defined by lR m if l is perpendicular to m for all l, m∈ L. Then, R is

a) reflexive b) Asymmetric c) transitive d) symmetric

3. Let R a relation on N x N defined by (a, b) R (c, d) => a + d = b + c Then R is

a) An equivalence relation

b) Symmetric and transitive but not reflexive

c) Reflexive and symmetric but not transitive

d) Reflexive and transitive but not symmetric

4. Let S be the set of all straight lines in a plane. Let R be a relation on S defined by a$Rb \Leftrightarrow a \parallel b$. Them, R is

a) reflexive and transitive but not symmetric b) reflexive and symmetric but not transitive

c) symmetric and transitive but not reflexive d) an equivalence relation

5. Let X = $\{x^2 : x \in N\}$ and the relation f : N → X is defined by $f(x) = x^2$, $x \in N$. Then, this function is

a) bijective b) surjective only c) not bijective d) injective only

6. Let N be the set of natural numbers and the function f : N→ N be defined by f (n) = 2n + 3 ∀ n ∈ N. Then f is

a) surjective and bijective b) surjective c) injective d) bijective

7. The relation S defined on the set R of all real number by the rule a S b if a≥ b is
a) reflexive, transitive but not symmetric b) symmetric, transitive but not reflexive
c) neither transitive nor reflexive but symmetric d) an equivalence relation

8. Let S be the set of all real numbers. Then the relation R = {(a, b) : 1 + ab > 0} on S is
a) reflexive symmetric and transitive b) symmetric and transitive but not reflexive
c) reflexive and transitive but not symmetric d) reflexive and symmetric but not transitive

Assertion(A)/Reason(R) Based (9-10): In the following questions, 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.

9. Assertion (A): Let A = {2, 4, 6} and B = {3, 5, 7, 9} and defined a function f= {(2, 3), (4, 5), (6, 7)} from A to B. Then, f is not onto.
Reason (R): A function f : A → B is said to be onto, if every element of B is the image of some elements of A under f.

10. Assertion (A): Let a relation R defined from set B to B such that B = {1, 2, 3, 4} and R = {1, 1), (2, 2), (3, 3), (1, 3), (3, 1)}, then R is transitive.
Reason (R): A relation R in set A is called transitive, if (a, b) ∈ Rand(b, c) ∈ R ⇒ (a, c) ∈ R, ∀ a, b, c ∈ A.

SECTION – B

Questions 11 to 20 carry 2 marks each

11. Show that the function f :$N \rightarrow N: f(x) = x^2$ is one - one and into.

12. Let N be the set of natural numbers and R be the relation on N× N defined by (a, b) R (c, d) iff ad = bc for all a, b, c, d ∈ N. Show that R is an equivalence relation.

13. Let S be the set of all real numbers. Show that the relation R = {(a, b): $a^2 + b^2 = 1$} is symmetric but neither reflexive nor transitive.

14. State whether the function is one - one, onto or bijective. Justify your answer. f: R→ R defined by f(x) = 1+ x^2

15. Show the relation R in the set A = {x ∈ Z : 0 ≤ x ≤ 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 1in each case.

16. A function f is defined from R→ R as f(x) = ax + b, such that f(1) = 1 and f(2) = 3. Find function f(x). Hence, check whether function f(x) is one - one and onto or not.

17. Let A be the set of all lines in xy - plane and let R be a relation in A, defined by R $=\{(L_1, L_2): L_1 \parallel L_2\}$. Show that R is an equivalence relation in A .

18. Let A = {x: x∈ Z : 0 < x < 12}. Show that R = {(a, b): | a - b | is a multiple of 4} is
a) reflexive. b) symmetric. c) transitive
and also find the set of elements related to 1.

19. Let f : N→ N be defined by $f(n) = \begin{cases} n+1, & if\ n\ is\ odd \\ n-1, & if\ n\ is\ even \end{cases}$ Show that f is a bijection.

20. Let S be the set of all real numbers and let R be a relation in S, defined by R = (a, b) : a ≤ b)Show that R is reflexive and transitive but not symmetric.

SECTION – C

Questions 21 to 24 carry 3 marks each

21. State whether the function is one – one, onto or bijective f: R to R defined by f(x) = 3 – 4x.

22. Show that the function f in A = R - $\left\{\frac{2}{3}\right\}$ defined as f (x) = $\frac{4x+3}{6x-4}$ is one - one and onto. Hence, find f $^{-1}$.

23. If N denotes the set of all natural numbers and R be the relation on N× N defined by (a, b) R (c, d), if ad(b + c) = bc(a + d). Show that R is an equivalence relation.

24. Show that the relation S in set ℝ of real numbers defined by
S = {(a, b): a ≤ b ^{3} , a ∈ ℝ , b ∈ ℝ } is neither reflexive, nor symmetric, nor transitive.

SECTION – D

Questions 25 to 28 carry 5 marks each

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

26. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a – b| is divisible by 2} is an equivalence relation. Write all the equivalence classes of R.

27. Let A = [- 1, 1] . Then, discuss whether the following functions defined on A are one - one, onto or bijective:
a) $f(x) = \frac{x}{2}$ b) g(x) = |x| c) h(x) = x|x| d) k(x) = x^2

28. Let A = {1, 2, 3, ...9} and R be the relation in A× A defined by (a, b) R (c, d) if a + d = b + c for (a, b), (c, d) in A × A. Prove that R is an equivalence relation and also obtain the equivalence class [(2, 5)] .

SECTION – E (Case Study Based Questions)

Questions 29 & 30 carry 4 marks each

29. Read the following text carefully and answer the questions that follow:

Sherlin and Danju are playing Ludo at home during Covid - 19. While rolling the dice, Sherlin's sister Raji observed and noted the possible outcomes of the throw every time belongs to set {1, 2, 3, 4, 5, 6}. Let A be the set of players while B be the set of all possible outcomes.

A = {S, D}, B = {1, 2, 3, 4, 5, 6}

a) Let R : B→ B be defined by R = {(x, y): y is divisible by x}. Determine whether R is Reflexive, symmetric or transitive. (1)

b) Raji wants to know the number of functions from A to B. How many number of functions are possible? (1)

c) Let R be a relation on B defined by R = {(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)}. Then describe R . (2)

OR

Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible? (2)

30. Read the following text carefully and answer the questions that follow:

A relation R on a set A is said to be an equivalence relation on A if it is

Reflexive i.e., (a, a) ∈ R ∀ a ∈ A.

Symmetric i.e., (a, b) ∈ R ⇒ (b, a) ∈ R ∀ a, b ∈ A.

Transitive i.e., (a, b) ∈ R and (b, c) ∈ R ⇒ (a, c) ∈ R ∀ a,b, c ∈ A.

a) If the relation R ={(1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)} defined on the set $\{A - 1,2,3\}$, then define if R is reflexive, symmetric or transitive. (1)

b) If the relation R = $\{(1,2),(2,1),(1,3),(3,1)\}$ defined on the set $A = \{1,2,3\}$, then check whether R is reflexive, symmetric or transitive (1)

c) If the relation R on the set N of all natural numbers defined as $R - \{(x,y): y = x + 5\}$ and x < 4, then check whether R is reflexive, symmetric or transitive. (2)

OR

If the relation R on the set $A = \{1,2,3, \ldots .13,14\}$ defined as R = $\{(x,y): 3x - y = 0\}$, then define R. (2)

Relation and Function Paper Details – Analysis		
Objective Questions		
MCQ	1 marks x 8 question = 8	
Assertion Reason	1 marks x 2 question = 2	
Subjective		
Short type I	2 marks x 10 question = 20	
Short type II	3 marks x 4 question = 12	
Long Type	5 marks x 4 question = 20	
Case Studies Based		
Case 1	4 marks	
Case 2	4 marks	

Total = 70 marks Your Score =