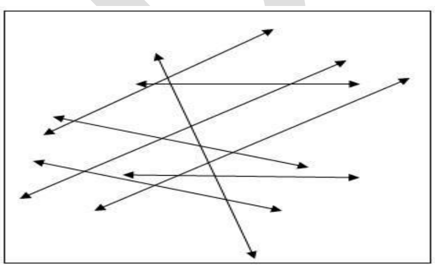
CLASS-XII
CHAPTER-01
RELATION AND FUNCTION
01 MARK TYPE QUESTIONS

Q. No.	QUESTION	MARK
1	Let A be the set of all human beings of a joint family living in TATA NAGAR. Then the relation defined as: R = {(x, y) : x is wife of y} is --------- (a) reflexive (b) symmetric (c) transitive (d) none of these	1
2	Let A be the set of all human beings living in a joint family in Cuttack.  Then the relation in set A defined as: R = {(x, y) : x is father of y} is ----------------- (a) reflexive (b) symmetric (c) transitive (d) none of these	1
3	Let L be the set of all lines in XY-plane and R be the relation in L defined as R = {L_1, L_2): L_1 is parallel to L_2}.  Which of the following lines related to the line $3x - y - 1$=0. (a) $6x - y + 1 = 0$ (b) $6x - 2y - 3 = 0$ (c) $3x + y + 1 = 0$ (d) $9x + 3y + 5 = 0$	1
4	Let A = {1, 2, 3}. Then number of equivalence relations containing (1, 2), (2,3) and (1, 3) is ---------- (a) 1 (b) 2 (c) 3 (d) 4	1

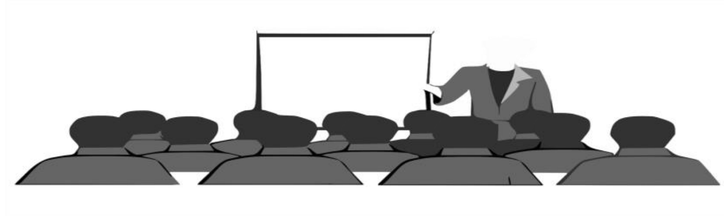
5	Consider a group consisting four friends.  Then the number of symmetric relations defined in that group is --------------- (a) 2^4 (b) 2^{10} (c) 2^{16} (c) 2^{12}	1
6	Jim and Jeny are solving some problems on relations and functions. Jim has a set A containing four natural numbers and Jeny has a set B containing three alphabets.  Jim wants to find the number of all possible onto functions from A to B. What will be his answer? (a) 3^4 (b) 4_{P_3} (c) 0 (d) 36	1
7	The function f: N→N defined by f(x) = x – 1 and f(1) = f(2) = 1 for every x > 2 is (a) One-one and onto (b) One-one but not onto (c) Onto but not one-one (d) Neither one-one nor onto	1
8	Let A be the set of all 50 students of Class X in a school. Let f : A → N be function defined by f (x) = roll number of the student x. (a) f is neither one-one nor onto. (b) f is one-one but not onto (c) f is not one-one but onto (d) none of these	1
9	For real numbers x and y, define xRy if and only if $x - y + \sqrt{2}$ is an irrational number. Then the relation R is ------------ (a) reflexive only (b) reflexive, symmetric but not transitive (c) equivalence relation (d) neither reflexive nor symmetric nor transitive	1
10	Assertion(A): If n (A) =p and n (B) = q then the number of relations from A to B is 2^{pq}. Reason(R): A relation from A to B is a subset of AXB. Which of the following options is correct? (a) Both A and R are true and R is correct explanation of A (b) Both A and R are true and R is not the correct explanation of A (c) A is true but R is false (d) A is false but R is true	1

11	Let R be a relation on the set N given by R = {(a, b) : a = b - 2, b > 6}. Then (a) (2, 4) $\in$ R (b) (3, 8) $\in$ R (c) (6, 8) $\in$ R (d) (8, 7) $\in$ R	1
12	Which of the following is not an equivalence relation on Z? (a) a R b $\Leftrightarrow$ a + b is an even integer (b) a R b $\Leftrightarrow$ a − b is an even integer (c) a R b $\Leftrightarrow$ a < b (d) a R b $\Leftrightarrow$ a = b	1
13	Let A = {1, 2, 3}. Then, the number of relations containing (1, 2) and (1, 3) which are reflexive and symmetric but not transitive is- a)1 b)2 c)3 d)4	1
14	The relation 'R' in N × N such that (a, b) R (c, d) <=> a+d = b+c a) reflexive but not symmetric b) reflexive and transitive but not symmetric c) an equivalence relation d) none of these	1
15	If A = {1, 2, 3}, B = {1, 4, 6, 9} and R is a relation from A to B defined by 'x is greater than y'. The range of R is {1, 4, 6, 9} {4,6,9} {1} None of these	1
16	f : R ----> R given by f(x) = $x + \sqrt{x^2}$ (a)Injective (b) surjective (c) bijective (d) none of these	1
17	The function f : R → R defined by f(x) = 2x + 2|x| is (a) one-one and onto (b) many-one and onto (c) one-one and into (d) many-one and into	1
18	The range of the function f (x) = $^{7-x}P_{x-3}$ is (a) {1, 2, 3, 4, 5} (b) {1, 2, 3, 4, 5, 6} (c) {1, 2, 3, 4} (d) {1, 2, 3}	1

19	Which of the following functions from Z to itself are bijections? (a) $f(x) = x^3$ (b) $f(x) = x + 2$ (c) $f(x) = 2x + 1$ (d) $f(x) = x^2 + x$	1
20	if a function $f : [2, \infty) \rightarrow B$ defined by $f(x) = x^2 - 4x + 5$ is a bijection, then B = (a) R (b) $[1, \infty)$ (c) $[4, \infty)$ (d) $[5, \infty)$	1
21	In an assembly line, let us consider two machines A & B working in an arranged manner. If the machine were setup in such a manner that the materials input in machine B is the product of materials obtained from the machine A. Then, what type of work can this be considered as: (a) Binary function (b) Bijective function (c) Composition of function (d) Trivial relation	1
22	When we apply for any qualifying examinations like SSB, NET, etc.., we were provided with an application ID number. In order to have confidentiality, each ID were assigned with the password provided by the board in-charge of the examination, which is to be inserted at the time of examination. What type of function is found in this example? (a) One-one onto function (b) One-one into function (c) One-one function (d) None of these	1
23	While shopping in the market, we use many methods of calculation (namely addition, subtraction, multiplication, division). We observe that we mainly use two numbers to use these operators. Even when there are three numbers, we first use the first two umbers and the result is then used along with third number. Thus, addition, subtraction, multiplication, division are considered to be binary operators. Assume that the numbers you have come across belong to the natural number. Then, which of the following statement is false according to the above condition? (a) Addition & subtraction are binary operators in N. (b) Subtraction & division are not binary operators in N. (c) Addition is binary operators in N. (d) Multiplication is binary operator in N.	1
24	Assertion-Reason Based Question: Each question consists of two statements, namely, Assertion (A) and Reason (R). Mark your answer as per the codes provided below: (1) Both A and R are true and R is the correct explanation of A. (2) Both A and R are true but R is not the correct explanation of A. (3) A is true but R is false.	1

	(4) A is false but R is true. Assertion (A): If we consider two function f & g, and the outcome of f become the input of g, for it to be called composition of function. Reason (R): Two function f & g is a composite function (i.e., gof) exists iff range of f is a subset of domain of g.	
25	Consider two machine A & B, for it to be working in an arranged manner, the materials of B come from the product/output of machine A. if we change the method of inserting the material i.e.., if the material A gets its material directly from the product of machine B. Then, could the machine work in the same manner as before? (a) No, the machine will not work for the second case in the same manner as before. (b) Yes, it will work. (c) No, it will not work because the composition of two function is not commutative in nature. (d) Can't say	1
26	Let us consider a group of all prime number and a group of all even numbers. So, when we construct a pair containing the data from both the group. What type of relation did we get? (a) Reflexive relation (b) Symmetric relation (c) Transitive relation (d) Equivalence relation	1
27	During a lecture session provided by Pawan sir on topic sets, he has pointed out main topics along with some frequently asked question. If we consider all the concept provided by him to be in a group and the outcome contains all the doubts asked by the students. Then, according to the above-mentioned concept, which of the following statements is consider to be false? (a) The group contain all the provided concept can be called domain of the relation. (b) The unsolved question asked by the students is called codomain of the relation. (c) The group containing all the provided concept can be called codomain of the relation (d) The range of the relation is all those questions related to concept being taught by sir.	1
28	In order to make ice-cream, we need milk, sugar, water & any food essence to be put in the ice-cream maker. The expected outcome will be obviously ice-cream of that particular food essence. Which of the following represent this given example? (a) Function (b) Relation (c) Trivial relation (d) None of these	1
29	In order to maintain the voltage, we need stabilizers. In stabilizers, whatever measurement of voltage like for example 200V, 220V, 240V, even 260V of voltage is passed, the output will always be 240V, because the work of the stabilizer is to give a constant voltage in return. This is example shows what type of function? (a) One-one function (b) One-many function (c) Onto function (d) Many-one function	1
30	Assertion-Reason Based Question:	1

	Each question consists of two statements, namely, Assertion (A) and Reason (R). Mark your answer as per the codes provided below: (1) Both A and R are true and R is the correct explanation of A. (2) Both A and R are true but R is not the correct explanation of A. (3) A is true but R is false. (4) A is false but R is true. Assertion (A): If we consider two function R and N containing the roll number and name of Class X students. We observe that while compositing R & N, to get RoN, first R then N is applied, while in reverse process, first the reverse process of N is applied and then reverse process of R is applied. Both the process is applicable. Reason (R): Inverse is defined only for the function which is onto function.	
31	Raju has a unique type of ludo die on which each number of {1,2,3} appear on two faces of the die then Maximum number of equivalence relations on the set A={1,2,3} are ?  **(A)** 1 **(B)** 2 **(C)** 3 **(D)** 5	1
32	Ramesh has two natural number i.e. a and b and fix a relation R between a and b which is given mathematically as R ={(a,b) :a=b-2,b>6} then What is your view about type of R? (A) Reflexive (B) Symmetric only (C) Non-Transitive (D) Equivalence	1
33	A students have 3 pen and 4 pencil. Then number of injective mapping that can be defined from set of pen to set of pencil is. (A) 144 (B) 24 (C) 12 (D) 64	1
34	The function $f: N \rightarrow N$ is defined by $f(n) = \begin{cases} \frac{n+1}{2}; if\ n\ is\ odd. \\ \frac{n}{2}; if\ n\ is\ even. \end{cases}$ The function f is. **(A)** Bijective **(B)** One-one but not onto (C) Onto but not one-one (D) Neither one-one nor onto	1
35	A teacher of Maths defines a function in front of the students of class-12 such that $f: R \rightarrow R$ is defined by $f(x) = 4 + 3\cos x$ and ask them to check the type of function.	1

	 **(A)** Bijective (B) One-one but not onto (C) Onto but not one-one (D) Neither one-one nor onto	
36	The function $f: R \rightarrow R$ is defined by $f(x) = 2 + x^2$ is **(A)** Neither one-one nor onto **(B)** Not One-one (C) One-one (D) Not onto.	1
37	Two students are playing a game “They count the number of students in two different class in their school” A there are four relation defined on these sets as follow which of the following is the reflexive relation.  (A) R ={(x,y) ; x>y x,y>N} (B) R ={(x,y) ;x.yis the square number x,y>N} (C) R ={(x,y) ;x+y=10 ; x,y>N} (D) R ={(x,y) ;x+4y=10 ; x,y>N}	1
38	Let L denotes the set of all straight line in a plane. Let a relation R defined by l R m if and only if l is perpendicular to m. **(A)** Reflexive **(B)** Symmetric only **(C)** Non-Transitive **(D)** None of these	1
39	The following questions consist of two statements-Assertion (A) and Reason (R).Answer these questions selecting the appropriate option given bellow: (a) Both A and R are true and R is the correct explanation for A (b) Both A and R are true and R is not correct explanation for A (c) A is true and R is false. (d) A is false and R is true. Assertion (A): Let A ={1,2,3} then the relation on A as R={(1,2),(2,1)} R is not transitive relation	1

	Reason (R) :A relation R defined on a non empty set A is said to be transitive relation if (a,b), (b,c) ϵ R ⇒ (a,c) ϵ R	
40	The following questions consist of two statements-Assertion (A) and Reason (R).Answer these questions selecting the appropriate option given bellow: (a) Both A and R are true and R is the correct explanation for A (b) Both A and R are true and R is not correct explanation for A (c) A is true and R is false. (d) A is false and R is true. Assertion (A): Let $f: R \rightarrow R$ such that $f(x) = x^2$ the function f is an onto function. Reason (R) : A function Let $g: A \rightarrow B$ is said to be onto function if g(A)=B ie.range of g=B	1
41	Let R be a relation on the set N given by R = { (a,b) : a = b-2,b > 6} then, **(a)** (2,4) $\in R$ (b) (3,8) $\in R$ (c) (6,8) $\in R$ (d) (8,7) $\in R$	1
42	If A ={ a,b,c} then the relation R ={(b,c)} on A is **(a)** Reflexive only (b) Symmetric only (c) Transitive only (d) reflexive & transitive only	1
43	The relation R in NXN such that (a,b) R (c,d) → a+d = b+c is **(a)** Reflexive but not symmetric (b) reflexive & transitive but not Symmetric (c) Equivalence relation (d) none of these	1
44	The relation S defined on the set R of all real number by the rule a S b iff a ≥ b is (a) An equivalence relation (b) reflexive & transitive but not Symmetric (c) Symmetric, transitive & but not reflexive (d) Neither transitive nor reflexive but symmetric	1
45	The maximum number of equivalence relations on the set A = { 1,2,3} is **(a)** 1 (b) 2 (c) 3 (d) 5	1
46	The function f: f:R → R ,given by f(x)=cosx is **(a)** One-one (b) many one (c) onto (d) neither one-one nor onto	1
47	Let R be the relation on N defined by x+2y=8. The domain of R is **(a)** {2,4,8} (b) {2,4,6,8} (c) {2,4,6} (d) {1,2,3,4}	1
48	If A{1,2,3}, B={1,4,6,9} and R be the relation from A to B defined by "x greater than y". The range of R is **(a)** {1,4,6,9} (b) {4,6,9} (c) {1} (d) none of these	1
49	If R is the largest equivanence relation on a set A & S in any relation on A then **(a)** $R \subset S$ (b) S⊂ R (c) $R = S$ (d) none of these	1
50	The function f:N → N ,given by f(x) = $\begin{cases} \frac{n+1}{2} & , if\ n\ is\ odd \\ \frac{n}{2} & , if\ n\ is\ even \end{cases}$ is **(a)** One-one (b) many one -onto (c) onto (d) many one -into	1

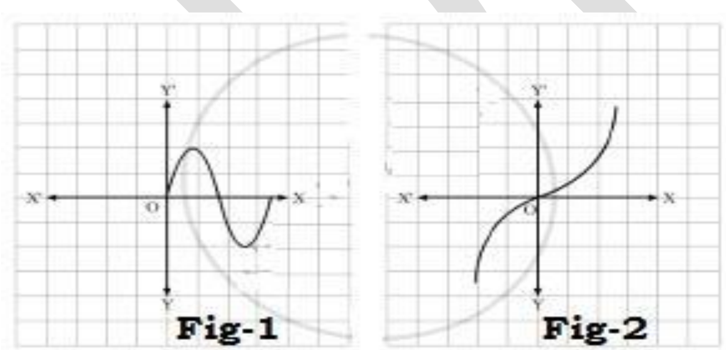
51	The relation R on the set $A = \{a, b, c\}$ given by $R = \{(a, b), (b, a), (c, c)\}$ is (a) symmetric and transitive, but not reflexive (b) reflexive and symmetric, but not transitive (c) symmetric, but neither reflexive nor transitive (d) an equivalence relation	1
52	The number of reflexive relations on a set A consisting of n elements is equal to (a) 2^{n^2} (b) n^2 (c) $2^{n(n-1)}$ (d) $n^2 - n$	1
53	The number of symmetric relations on set $\mathrm{A} = \{1, 2, 3, 4\}$ is (a) 2^{10} (b) 2^6 (c) 2^{12} (d) 2^{16}	1
54	The number of equivalence relations in the set $\{1, 2, 3\}$ containing the elements (1, 2) and (2, 1) is (a) 0 (b) 1 (c) 2 (d) 3	1
55	The maximum number of equivalence relation on the set $A = \{1, 2, 3\}$ (a) 1 (b) 2 (c) 3 (d) 5	1
56	Set A contains 5 elements and set B contains 6 elements, then the number of one-one mapping from A to B is (a) 720 (b) 120 (c) 6^5 (d) 5^6	1
57	The function $f: R \to R$ defined as $f(x) = x^3$ is (a) one-one but not onto (b) not one-one but onto (c) neither one-one nor onto (d) one-one and onto	1
58	Let $A = \{1, 2,3, \dots \dots n\}$ and $B = \{a, b\}$. Then the number of surjections from A into B is (a) n_{P_2} (b) $2^n - 2$ (c) $2^n - 1$ (d) none of these	1
59	The function $f: R \to R$ defined by $f(x) = 4 + 3\cos x$ is (a) bijective (b) one-one but not onto (c) onto but not one-one (d) neither one-one nor onto	1
60	Which of the following functions from Z to Z is a bijection? (a) $f(x) = x^2$ (b) $g(x) = x + 2$ (c) $f(x) = 2x + 1$ (d) $f(x) = x^2 + 1$	1

ANSWER
CHAPTER-01
RELATION AND FUNCTION
01 MARK TYPE QUESTIONS

Q.No	ANSWERS	Mark
1	(c) transitive	1
2	(d) none of these	1
3	(b) $6x - 2y - 3 = 0$	1
4	(a) 1	1
5	(b) 2^{10}	1
6	(d) 36	1
7	(c) Onto but not one-one	1
8	(b) f is one-one but not onto	1
9	(a) reflexive only	1
10	(a) Both A and R are true and R is correct explanation of A	1
11	c	1
12	c	1
13	a	1
14	c	1
15	c	1
16	d	1
17	c	1
18	d	1
19	b	1
20	b	1
21	(c)	1
22	(a)	1
23	(a)	1
24	(1)	1
25	(c)	1
26	(c)	1
27	(c)	1
28	(a)	1
29	(d)	1
30	(3)	1
31	D	1
32	C	1
33	B	1
34	C	1
35	D	1

36	A	1
37	B	1
38	D	1
39	A	1
40	A	1
41	**C**	1
42	c	1
43	c	1
44	b	1
45	d	1
46	d	1
47	c	1
48	c	1
49	b	1
50	b	1
51	c	1
52	c	1
53	a	1
54	c	1
55	d	1
56	a	1
57	d	1
58	b	1
59	d	1
60	b	1

CLASS-XII
CHAPTER-01
RELATION AND FUNCTION
02 MARKS TYPE QUESTIONS

Q. No.	QUESTION	MARK
1	An equivalence relation R in A divides it into three equivalence classes A_1, A_2, A_3. What is the value of the following? (i) $A_1 \cup A_2 \cup A_3$ (ii) $A_1 \cap A_2 \cap A_3$	2
2	Are the following set of ordered pairs functions?. (i) {(x, y): x is a person, y is the mother of x}. (ii) {(a, b): a is a person, b is an ancestor of a} If so, examine whether the mapping is one-one, many-one or onto.	2
3	Let A = {a, b, c} and the relation R be defined on A as follows: R = {(a, a), (b, c), (a, b)}. Then, write the minimum number of ordered pairs to be added in R to make R reflexive and transitive.	2
4	Given A = {2, 3, 4}, B = {2, 5, 6, 7}. Define a function from A to B such that the function is: (a) an injective mapping from A to B (b) a mapping from A to B which is not injective	2
5	Which of the following graph represents one-one function? Fig-1 or Fig-2?  Justify your answer.	2
6	If R = {(a, a3): a is a prime number less than 5} be a relation. Find the range of R	2

7	Let R is the equivalence relation in the set A = {0,1, 2, 3, 4, 5} given by R = {(a, b) : 2 divides (a – b)}. Write the equivalence class .	2
8	If R = {(x, y): x + 2y = 8} is a relation on N, then write the range of R.	2
9	Show that the function f: R → R, defined as $f(x) = x^2$, is neither one-one nor onto.	2
10	Show that the function $f:R\rightarrow(x\in R:-1<x<1)$ defined by $f(x)= x/(1+\|x\|)$, $x\in R$ is one one and onto function.	2
11	Let us take an example if suppose we have a set X consisting of exactly 200 elephants in a farm. Are there any chances of finding a relation of getting a rabbit in the poultry farm? 	2
12	Pablo charges $20 an hour to teach salsa dancing. What is the domain and range of how much money Pablo can make off salsa dancing lessons. 	2
13	Curtis hit 5 home runs in his first game and 3 home runs in each game after that. However, he didn't hit a home run in his 4th game. Find the Domain and Range. Hint: There is a hole in the game that he didn't hit a homerun.	2
14	If a car is traveling 35 miles per hour, a function can be used to determine how far they have traveled after 1 hour, 2 hours, 3 hours, etc. Explain?	2
15	Three friends X, Y, and Z live in the same society close to each other at a distance of 4 km from each other. If we define a relation R between the distances of each of their houses. Can R be known as an equivalence relation? 	2
16	Define symmetric relation. Give one example	2

17	A Mathematics teacher is going to conduct a test of class-12 students, teacher put the question in front of the students such that  Let A=**R**-{2},B=**R**-{1}. Let $f: A \rightarrow B$ be defined by $f(x) = \frac{x-1}{x-2} \forall\, x \in A$ .Show that $f(x)$ is One-one function.	2
18	Let R be the relation defined on the natural number N as follow: R={(x,y): x, $y \in$ N and 2x+y=24}. Find the domain and range of the relation	2
19	A traffic light is indicated according to the range of the function as given bellow $f(x) = \frac{\lvert x-1 \rvert}{x-1}; x \neq 1$. Then find the range of the function  	2
20	Define one-one function. Give one example	2
21	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.	2
22	Show that the modulus function f:R → R ,given by f(x) = |x| is neither one one nor onto.	2
23	State the reason for relation R in the set {1,2,3} given by R ={ (1,2), (2,1) } not to be transitive.	2
24	Let f:R → R be defined by $\begin{cases} 3x & ,if\ x > 3 \\ x2 & ,if\ 1 < x \leq 3 \\ x & ,if\ x \leq 1 \end{cases}$,then find f(-2)+ f(0)+ f(2) +f(5)	2
25	Find the range of $f(x) = \frac{x-1}{x+1}$	2
26	Show that the relation R in the set {1,2,3} given by R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)} is reflexive but neither symmetric nor transitive.	2
27	Show that the modulus function $f : R \rightarrow R$, given by $f(x) = \lvert x \rvert$ is neither one-one nor onto. $f : R \rightarrow R$, given by $f(x) = \lvert x \rvert$	2
28	Prove that the function f is surjective, where $f: N \rightarrow N$ such that $f(n) = \begin{cases} \frac{n+1}{2}, if\ n\ is\ odd \\ \frac{n}{2},\ if\ n\ is\ even \end{cases}$. Is the function injective? Justify your answer.	2

29	Show that the function $f: R_+ \to [4, \infty)$ given by $f(x) = x^2 + 4$ is a bijective function.	2
30	Write the inverse relation corresponding to the relation R given by $R = \{(x, y): x \in N, x < 5, y = 3\}$. Also write the domain and range of inverse relation.	2

ANSWER
CHAPTER-01
RELATION AND FUNCTION

Q.No	**ANSWERS**	**Mark**
1	(i) $A_1 \cup A_2 \cup A_3 = A$ (ii) $A_1 \cap A_2 \cap A_3 = \emptyset$	1+1
2	(i) {(x, y): x is a person, y is the mother of x}. It is a function and it is many-one as each person has only one biological mother and two or more person may have same mother. (ii) {(a, b): a is a person, b is an ancestor of a}. It is not a function as a person has more than one ancestor.	2
3	To make reflexive minimum two order pairs i.e. (b, b) and (c, c) must be added. To make transitive (a,c) must be added. So to make reflexive and transitive minimum three ordered pair must be added. Those are (b, b), (c, c) and (a,c).	2
4	(a) an injective mapping from A to B. Ex: $f = \{(a, b): b = a + 3, for\ all\ a \in A\ and\ b \in B$. Here $f = \{(2,5), (3, 6), (4, 7)\}$ (b) a mapping from A to B which is not injective. Ex: $f = \{(a, b): b = a^2 - 6a + 5, for\ all\ a \in A\ and\ b \in B$. Here (-3) is the image of both 2 and 4.	2
5	Fig-2 is one-one as when a line is drawn parallel to x-axis, it will intersect the curve at only one point. That means for each x there is unique y. But in Fig-1, a line drawn parallel to x-axis will intersect at two points. It means for two values of x, there is one image. Hence not one-one.	2
6	Given, R = {{a, cd): a is a prime number less than 5} We know that, 2 and 3 are the prime numbers less than 5. So, a can take values 2 and 3. Thus, R = {(2, 23), (3, 33)} = {(2, 8), (3, 27)} Hence, the range of R is (8, 27}.	2
7	Given, R = {(a, b):2 divides(a − b)} and A = { 0,1, 2, 3, 4, 5} Clearly, [0] = {b ∈ A : (0, b) ∈ R} = {b ∈ A: 2 divides (0 − b)}	2

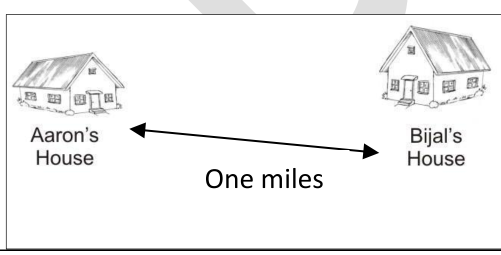
	= {b ∈ A : 2divides (−b)} = {0, 2, 4} Hence, equivalence class of [0] = {0,2,4}.	
8	Given, the relation R is defined on the set of natural numbers, i.e. N as R= {(x, y) : x + 2y = 8} To find the range of R, x + 2y = 8 can be rewritten as y = 8−x2 On putting x = 2, we get y = 8−22 = 3 On puttmg x = 4, we get y = 8−42 = 2 On putting x = 6, we get y = 8−62 = 1 As, x, y ∈ N, therefore R = {(2, 3), (4, 2), (6, 1)}. Hence, the range of relation R is {3,2,1}. Note: For x = 1, 3, 5, 7, 9, ……… we do not get y as natural number.	2
9	Given the function f:R→R defined as f(x)=x2. Now we have 2,−2∈R but f(2)=f(−2)=4. This gives that the function f(x) is not one-one.	2
10	f:R⇒(x∈R:−1<x<1) f(x)=x/(1+ |x|),x∈R Lets check it for ±1/2∈(−1,1) ⇒f(1/2)= (1/2)/(1+1/2)=1/3 And f=(-1/2)=(−1/2)/ (1 − 1/2) = −1 f(x) is different for each x∈(−1,1) ⇒f is one - one. And f(x) exists and gives real value for ∀x∈(−1,1) ⇒f is onto. ⇒f is one-one onto.	2
11	Let us consider, X= {set containing 200 elephants in a farm} Y= {set of rabbits} When we consider the relation R between X and Y such that R= {(X, Y): X contain elephants}, we observe that the relation R is void or empty relation since there is only 200 elephants in the farm and no rabbit can be found.	2
12	The number of hours he teaches will go on the x-axis and the amount of money Pablo makes goes on the y axis. The least amount of money he can make is $0 dollars because he can only make money and he can't go in debt. The equation is y=20x because it costs $20 an hour and x represent the number of hours he teaches. Hence, The domain is [0, ∞) and the range is also [0, ∞).	2
13	The number of home runs Curtis hit in a game can be represented by the Function f(x) So, f(x) = 5 if x = 1, and f(x) = 3 if x > 1.	2

	However, there is a hole at x = 1, where Curtis did hit a home run. So, we need to remove that point from the domain. Therefore, the domain of the function is {x | x > 1}, and the range is {3,5}. Alternatively, we can write the function as: f(x) = {5, if x = 1, 3, if x > 1 and x is an integer, undefined, otherwise} In this case, the domain is all real numbers except for x = 1, and the range is still {3, 5}.	
14	Car is traveling 35 miles per hour. We have to determine how far they travel after 1, 2, 3, etc... hour. According to the question, This function would look like: Miles driven= 3x, where x is equal to the number of hours. If this person drove for 1 hours, then the output would be 35 miles. If this person drove for 2 hours, then the output would be 70 miles. If this person drove for 3 hours, then the output would be 105 miles. If this person drove for 1.5 hours, then the output would be 52.5 miles.	2
15	We know that for an equivalence Relation, R must be reflexive, symmetric, and transitive. R is not reflexive as X cannot be at a distance of 4 km away from itself. The relation, R can be said as symmetric as the distance between X and Y is 4 km which is the same as the distance between Y and X. R is said to be transitive as the distance between X and Y is 4 km, the distance between Y and Z is also 4 km and the distance between X and Z is also 4 km. Therefore, this relation is not an equivalence relation.	2
16	SYMMETRIC RELATION: -.A relation R on a set A is called symmetric relation if aRb. For every a,b ∈ A ⇒b,a ∈ A also (1) Example:-A={1,2,3} A×A=[(1,2), (2,1), (1,1),(2,2),(3,3),(1,3),(2,3),(3,1),(3,2)] ∈ R Since (a,b) ∈ R ⇒(b,a) ∈ R for every a,b∈ A (1)	2
17	ONE-ONE FUNCTION: - $f(x_1) \neq f(x_2)$ or $(\frac{x_1-1}{x_1-2})=\frac{x_2-1}{x_2-2})$ $\Rightarrow x_1 = x_2$ $\therefore$ $f(x)$ is one one function (2)	2
18	R ={(1,22), (2,20), (3,18),(4,16),(5,14),(6,12),(7,10),(8,8),(9,6),(10,4),(11,2)} Domain={1,2,3,4,5,6,7,8,9,10,11} (1) Range={2,4,6,810,12,14,16,18,20,22} (1)	2
19	Range of the function Give that $f(x) = \frac{\lvert x-1\rvert}{x-1}; x \neq 1$ this function can be written as $f(x) = \begin{cases} \frac{x-1}{x-1}; if\ x > 1. \\ -\frac{x-1}{x-1}; if\ x < 1. \end{cases}$ Or $f(x) = \begin{cases} 1; x > 1 \\ -1; x < 1 \end{cases}$ Hence the range of $f(x)$ is {1,-1} (2)	2

20	ONE-ONE FUNCTION:- A function $f: A \rightarrow B$ is said to be one one if a≠b ⇒ $f(a) \neq f(b)$ for all a,b ∈ A or $f(a) = f(b)$ ⇒ a=b for all a,b ∈ A (1) Example:- Let $f: R \rightarrow R$ be a function such that $f(a)$ =x+1 is one-one function (1)	2
21	Let a ∈ A a≠a+1 → $(a, a) does\ not\ belongs\ to\ A$ so R is not reflexive.	2
22	**ONE-ONE :** Let $x_1 = 1$, $x_2 = -1$ be the two elements belongs to R F(x1) = f(x2) =1 F is many one. **ONTO:** let f(x) =-1 , |x| = -1 ∈ R which is not possible. So not ONTO	2
23	R is not transitive as (1,2) ∈ R , (2,1) ∈ R but (1,1) does not belongs to R	2
24	f(-2)+ f(0)+ f(2) +f(5) = $-2 + 0 + 2^2 + 3 * 5$ = -2 + 4+ 15 =17	2
25	Given R = {(1,1),(2,2),(3,3),(1,2),(2,3)} defined on R : {1,2,3}→{1,2,3} **<u>For reflexive</u>**: As (1, 1), (2, 2), (3, 3) ∈ R. Hence, reflexive **<u>For symmetric</u>**: (1, 2) ϵ R but (2, 1) ∉ R. Hence, not symmetric. **<u>For transitive</u>**: (1, 2) ϵ R and (2, 3) ∈ R but (1, 3) ∉ R. Hence, not transitive.	$\frac{1}{2}$ $\frac{1}{2}$ 1
26	Given f : R→R, given by $f(x) = \|x\|$ Take $x = 2$ and $x = -2$ then $f(2) = 2$ and $f(-2) = 2$ that is image of two distinct elements is same. Therefore f is not one-one. Also negative real numbers in co-domain have no pre-image in the domain. Therefore f is not onto.	1 1
27	**<u>Surjectivity</u>**: Let n be an arbitrary element of N. If n is an odd natural number , then $2n - 1$ is also an odd natural number such that $f(2n-1) = \frac{2n-1+1}{2} = n$. If n is an even natural number , then $2n$ is also an even natural number such that $f(2n) = \frac{2n}{2} = n$. Thus for every $n \in N$(whether even or odd) there exists its pre-image in N. So f is surjective. **<u>Injectivity</u>**: 1, 2∈ $N(domain)$ such that $f(1) = 1 = f(2)$. Hence f is not injective.	1 1
28	**One-One:** Let $x_1, x_2 \in R_+$ $(Domain)$ $f(x_1) = f(x_2) \Rightarrow {x_1}^2 + 4 = {x_2}^2 + 4$	1

	$\Rightarrow {x_1}^2 = {x_2}^2$ $\Rightarrow x_1 = x_2$ [x_1 & x_2 are positive real numbers]. Hence f is one-one function. **Onto:** Let $y \in [4, \infty)$ such that $y = f(x) \quad \forall\, x \in R_+$ $\Rightarrow y = x^2 + 4$ $\Rightarrow x = \sqrt{y-4}$ [x is a positive real number] Obviously, $\forall\, y \in [4, \infty)$, x is a real number $\in R_+$ $(Domain)$ *i.e.* all elements of codomain have pre-image in domain. $\Rightarrow f$ is onto. Hence f is a bijective function.	1
29	Given, $R = \{(x, y): x \in N, x < 5, y = 3\}$ $\Rightarrow R = \{(1,3), (2,3), (3,3), (4,3)\}$. Hence required inverse relation is $R^{-1} = \{(3,1), (3,2), (3,3), (3,4)\}$. Domain of $R^{-1} = \{3\}$. Range of $R^{-1} = \{1, 2, 3, 4\}$.	1 $\frac{1}{2}$ $\frac{1}{2}$

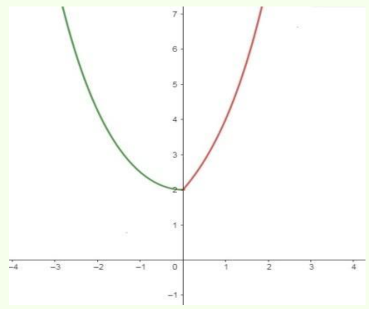
CLASS-XII
CHAPTER-01
RELATION AND FUNCTION
03 MARKS TYPE QUESTIONS

Q. No.	QUESTION	MARK
1	If R and S are equivalence relations on a set A, then prove that $R \cap S$ is also an equivalence relation.	3
2	Let S be the relation in real number R defined by $(a, b)\ S\ (c, d)\ if\ ad = bc$ for $a, b, c, d\ \epsilon\ R$ (set of real numbers). Prove that S is an equivalence relation.	3
3	Classify the function $f(x) = 2^x + 2^{\|x\|}$ as injection, surjection or bijections. Justify your answer.	3
4	Show that the relation R in the set {1, 2, 3} given by R= {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)} is reflexive but neither symmetric nor transitive.	3
5	Let A={1,2} . Find all one-to-one function from A to A.	3
6	Prove the function f:R→R given by f(x)=cosx for all x∈R, is neither injective nor surjective.	3
7	An electrician charges a base fee of Rs. 70 plus Rs. 50 for each hour of work. Create a table that shows the amount of the electrician charges for 1, 2, 3, & 4 hours of work. Let x represent the number of hours and y represent the amount charged for x hours. Is the relation a function?	3
8	Jimmy has to fill up his car with gasoline to drive to and from work next week. If gas costs $2.79 per gallon, and his car holds a maximum of 28 gallons, what is the domain and range of the function?	3
9	"x lives within one mile of y" – Show that it is reflexive, symmetric, but not transitive relation. 	3
10	Show that the relations S in the set of real numbers defined as S={ (a,b): a,b ϵ R and a$\leq b^3$} is neither reflexive nor symmetric nor transitive	3
11	Let A=**R**-{$\frac{2}{3}$},show that the function f in set A defined by $f(x) = \frac{4x-3}{6x-4}\ \ \forall\ x \in A$, is one-one and onto	3

12	Show that the relation R defined on the **set N×N** by (a,b) R (c,d) ⇒ $a^2 + d^2 = b^2 + c^2 \; \forall \; a, b, c, d \; \in \boldsymbol{N}$ is an equivalence relation	3
13	Let A = R-{3} ,B = R-{1} . If f:A → B be defined by $f(x) = \frac{x-2}{x-3} \quad \forall \; x \; \in A.$ Then show that f is bijective.	3
14	Let N denotes the set of all natural numbers and R be the relation on N X N defined by (a,b) R (c,d) if ad(b+c) = bc (a+d). Show that R is an equivalence relation.	3
15	Check whether the relation R in R defined by R ={(a,b^3) : a≤ b^3) is reflexive ,symmetric or transitive.	3
16	Show that the relation R in the set of real numbers, defined as R = {(a, b): a ≤ b^2} is neither reflexive nor symmetric nor transitive.	3
17	Let A = R−{3} and B = R−{1}. Consider the function f : A→B defined by f(x) = $\frac{x-2}{x-3}$. Show that f is one-one and onto.	3
18	Let Z be the set of all integers and R be the relation on Z defined as R = {(a, b) : a, b ∈ Z, and (a−b) is divisible by 5}. Prove that R is an equivalence relation.	3

ANSWER
CHAPTER-01
RELATION AND FUNCTION
03 MARKS TYPE QUESTIONS

Q.No	ANSWERS	Mark
1	Given that R and S are reflexive, symmetric and transitive. Reflexivity: Let $a \in A$. So, $(a,a) \in R$ and $(a,a) \in S$ (as R and S are reflexive) $\Rightarrow (a,a) \in R \cap S$. So, $R \cap S$ is reflexive. Symmetricity: Let $a, b \in A$ and $(a,b) \in R \cap S$ $\Rightarrow (a,b) \in R$ and $(a,b) \in S$ $\Rightarrow (b,a) \in R$ and $(b,a) \in S$ (as R and S are symmetric) $\Rightarrow (a,b) \in R \cap S$. So, $R \cap S$ is symmetric. Transitivity: Let $a, b, c \in A$ and $(a,b) \in R \cap S$ and $(b,c) \in R \cup S$ $\Rightarrow (a,b) \in R$ and $(a,b) \in S$ and $(b,c) \in R$ and $(b,c) \in S$ $\Rightarrow (a,b) \in R$, $(b,c) \in R$ and $(a,b) \in S$, $(b,c) \in S$ $\Rightarrow (a,c) \in R$ and $(a,c) \in S$ (as R and S are transitive) $\Rightarrow (a,c) \in R \cap S$. So, $R \cap S$ is transitive. Therefore, $R \cap S$ is an equivalence relation.	3
2	Reflexivity: Let $a, b \in R$ and $(a,b) \in R \times R$. Since, $ab = ba$ $\Rightarrow (a,b)S(a,b)$. So, S is reflexive. Symmetricity: Let $a, b, c, d \in R$ and $(a,b),(c,d) \in R \times R$ $Let\ (a,b)\ S\ (c,d)$ $\Rightarrow ad = bc$ $\Rightarrow bc = ad$ $\Rightarrow cb = da$ $\Rightarrow (c,d)\ S\ (a,b)$. So, S is symmetric. Transitivity: Let $a, b, c, d, e, f \in R$ and $(a,b),(c,d),\ (e,f) \in R \times R$	3

	$Let\ (a,b)\ S\ (c,d)$ and $(c,d)\ S\ (e,f)$ $\Rightarrow ad = bc \quad and \quad cf = de$ $\Rightarrow adcf = bcde$ $\Rightarrow af = be$ $\Rightarrow (a,b)\ S\ (e,f)$ So, S is transitive. Therefore R is an equivalence relation.	
3	 $f(x) = 2^x + 2^{\lvert x \rvert} = \begin{cases} 2.2^x & x \geq 0 \\ 2^x + 2^{-x} & x < 0 \end{cases}$ <u>Case-1</u>: $x \geq 0$ let $x_1, x_2 \geq 0$ and $f(x_1) = f(x_2)$ $\Rightarrow 2.2^{x_1} = 2.2^{x_2} \quad \Rightarrow x_1 = x_2$ <u>Case-2</u>: $x < 0$ Let $x_1, x_2 < 0$ and $f(x_1) = f(x_2)$ $\Rightarrow 2^{x_1} + 2^{-x_1} = 2^{x_2} + 2^{-x_2}$ $\Rightarrow 2^{x_1} - 2^{x_2} = 2^{-x_2} - 2^{-x_1} = \frac{1}{2^{x_2}} - \frac{1}{2^{x_1}}$ $\Rightarrow 2^{x_1} - 2^{x_2} = \frac{2^{x_1} - 2^{x_2}}{2^{x_2.} \times 2^{x_1}}$ $\Rightarrow (2^{x_1} - 2^{x_2})(2^{x_2.} \times 2^{x_1}) - 2^{x_1} - 2^{x_2} = 0$ $\Rightarrow (2^{x_1} - 2^{x_2})\{(2^{x_2.} \times 2^{x_1}) - 1\} = 0$ $\Rightarrow 2^{x_1} - 2^{x_2} = 0$ because $(2^{x_2.} \times 2^{x_1}) - 1 = 2^{x_1 + x_2.} - 1 \neq 0$ $\Rightarrow x_1 = x_2$ <u>Case-3</u>: let $x_1 \geq 0 \quad and \quad x_2 < 0$. Clearly, $x_1 \neq x_2$ Now, $f(x_1) = 2.2^{x_1} \geq 2$ and $f(x_2) = 2^{x_2} + 2^{-x_2} > 2$ Therefore, $f(x_1) can\ be\ equal\ to\ f(x_2) for\ some\ x_1, x_2$. So, f is a many-one function. Again since the value of $f(x) = 2^x + 2^{\lvert x \rvert} = \begin{cases} 2.2^x & x \geq 0 \\ 2^x + 2^{-x} & x < 0 \end{cases}$ for all $x \in R$ can not be negative, so f is not onto. {From the graph, it is clear that Range is $[2, \infty)$ and co-domain=R} Hence f is many-one and onto.	3
4	R={(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)} **<u>Reflexive</u>** If the relation is reflexive,then (a, a)∈R for every a∈{1, 2, 3}. Since (1, 1)∈R, (2, 2)∈R & (3, 3)∈R. Therefore, R is reflexive	3

Symmetric

To check whether symmetric or not, If $(a, b) \in R$, then $(b, a) \in R$.

Here $(1, 2) \in R$, but $(2, 1) \notin R$.

Therefore, R is not symmetric.

Transitive

To check whether transitive or not,

If $(a,b) \in R$ & $(b,c) \in R$, then $(a,c) \in R$.

Here, $(1, 2) \in R$ and $(2, 3) \in R$ but $(1, 3) \notin R$.

Therefore, R is not transitive.

Hence, R is reflexive but neither symmetric nor transitive

5 A={1,2} 3

one- one function from A to A.

f(x)=y

for every unique x, y should be unique.

f(x)→one

f(A)={1,1|2,2}

f(A)={1,2|2,1}

6 Injectivity : We know that $f(0)=\cos 0=1$ and $f(2\pi)=\cos 2\pi=1$. 3

So, different elements in R may have the same image. Hence, f is not an injection.

Surjectivity : Since the values of $\cos x$ lie between -1 and 1, it follows that the range of $f(x)$ is not equal to its co-domain. So, f is not a surjection.

7 The table can be drawn as: 3

X (hour)	Y	Base Fee	Total
1	50	70	120
2	100	70	170
3	150	70	220
4	200	70	270

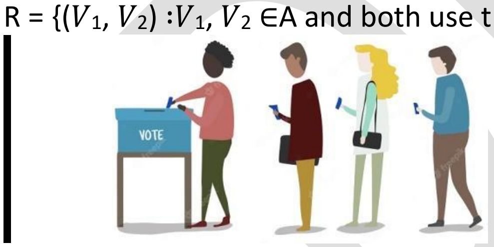
	The relation is a function such that Y= x * 50 Total = Y + 70 Also, Total = (x*50) + 70, where x number of hours We can see that each x element has only one y-element as well as total number associated with it. Hence, the relation is a function, since a function is a special type of relation where each input has exactly one output, and the output can be traced back to its input.	
8	The number of gallons of gas purchased will go on the x-axis and the costs of the gasoline goes on the y-axis. Because the least amount of gas he can purchase is 0 gallons which is \$0 then part of the function is $0 \le x$. The most amount of money he can spend on gas is \$78.12 which is the full 28 gallons. i.e., 2.79 * 28 gallons = 78.12 This adds to the function making it $0 \le x \le 28$. Then to complete the function because each gallon of gas cost \$2.79 and x represents the amount of gas bought the equation is $y=2.79x$ and $0 \le x \le 28$. Hence, **The domain is [0,28] and the range is [0,78.12]**	3
9	Perfectly valid as well: * Any person lives within a mile of themselves (namely zero distance), so it is reflexive. * If one person lives within a mile of another, that person consequently lives within a mile of the first, so it's symmetric. * It is not ensured that if Paul lives within a mile of John, who lives within a mile of Martha, that Paul is within a mile of Martha. For instance, if Paul and Martha are two miles apart, and John is exactly between the two, we see a lack of transitivity. Hence, the given relation is reflexive, symmetric but not transitive.	3
10	**S**={ (a,b): a,b ∈ R and a≤ b^3} **Refexive:- as** $\frac{1}{2} \le (\frac{1}{2})^3$ where $\frac{1}{2} \in R$, is not true $(\frac{1}{2},\frac{1}{2}) \notin$ S Thus S is not reflexive…… **(1)** **Symmetric:- as** $-2 \le (3)^3$ where (-2,30 ∈ S is true but $\mathbf{3} \le (-2)^3$ is not true. i.e. (-2,3) ∈ S but (3,-2) ∉ S **(1)** Therefore ,S is not symmetric . **Transitive:- As** $3 \le (\frac{3}{2})^3$ and $\frac{3}{2} \le (\frac{4}{3})^3$ where $3, \frac{3}{2}, \frac{4}{3}$ ∈ S are true but $3 \le (\frac{4}{3})^3$ is not true i.e. $(3,\frac{3}{2})$ ∈ S and $(\frac{3}{2},\frac{4}{3})$ ∈ S but $(3,\frac{4}{3}) \notin$ S. therefore S is not transitive **(1)** **Hence is neither reflexive nor symmetric nor transitive**	3

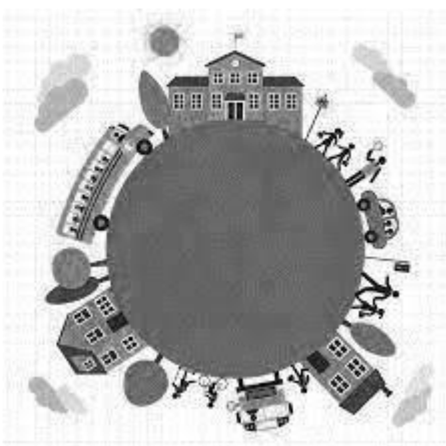
11	**Given that** $f(x)=\frac{4x-3}{6x-4}\ \ \forall\, x\in A$ **To show that f is One-One** **Let** $f(x_1)=f(x_2)$ Then $(\frac{4x_1+3}{6x_1-4})=\frac{4x_2+3}{6x_2-4}$ on solving this …. **$(\frac{1}{2})$** we get $x_1=x_2$ **(1)** **To show that f is Onto** **Let y** ϵ B so y= $f(x)$ …. $(\frac{1}{2})$ Or y=$\frac{4x-3}{6x-4}$ solve for x we get $x=\frac{4y+3}{6y-4}=g(y)\Rightarrow$ f is Onto function. **(1)**	3
12	**For Reflexive Relation** **Let** (a,b) ∈ N×N Then $since\ \ a^2+b^2=a^2+b^2$ (a,b) R (a,b) Hence R is reflexive relation **(1)** **Symmetric:- Let** (a,b),(c,d) ∈ N×N be such that (a,b) R (c,d) ⇒ $a^2+d^2=b^2+c^2$ ⇒ $c^2+b^2=d^2+a^2$ ⇒ (c,d) R (a,b) Hence R is symmetric relation **(1)** **Transitive:-** Let (a,b), (c,d), (e,f) ∈ N×N be such that (a,b) R (c,d) and (c,d) R (e,f) ⇒ $a^2+d^2=b^2+c^2$…………..(1) And ⇒ $c^2+f^2=d^2+e^2$………………(2) Adding equation.(1) and equation (2) ⇒ $a^2+d^2+c^2+f^2=b^2+c^2+d^2+e^2$ ⇒ $a^2+f^2=b^2+e^2$ ⇒ (a,b) R (e,f) Hence R is transitive relation **(1)** Since R is reflexive, symmetric and transitive Hence R is equivalence relation	3
13	**For injectivity :** $f(x_1)=f(x_2)$ therefore $\frac{x1-2}{x1-3}=\frac{\boldsymbol{x2-2}}{\boldsymbol{x2-3}}$ (x1-2)(x2-3) =(x1-3)(x2-2) X1.x2 -3x1 -2x2+6 = x1.x2 -3x2-2x1 +6 then x1 =x2 , f(x) is injective. **For Surjectivity:** $\boldsymbol{y}=\frac{\boldsymbol{x-2}}{\boldsymbol{x-3}}$; x-2 = xy – 3y ; $\boldsymbol{x}=\frac{\boldsymbol{2-3y}}{\boldsymbol{1-y}}\in A\ for\ every\ value\ of\ B$ So f is surjective Hence f is bijective.	3
14	**Reflexivity:** b+a =a+b , for a,b $\in N$ ab=ba , for a,b $\in N$ ab(b+a) =ba(a+b) , for a,b $\in N$ (a,b) R (b,a) , R is reflexive. **Symmetric:**	3

	=(a,b)R(c,d) ad(b+c)= bc(a+d) cb(d+a) = da(c+b) = (c,d) R (a,b) **Transitivity:** Let (a,b)R(c,d) and (c,d) R (e,f) then (a,b) R (e,f)	
15	**Reflexive** R ={(a,b^3) : a≤ b^3) Here $\frac{1}{3} \in R$ $\frac{1}{3} > \frac{1}{27}$ $(\frac{1}{3}, \frac{1}{3}) \notin R$ **Symmetric** Let $(1,2) \in R$ $1 \leq 8$ *or* $1 \leq 2^3$ but $(2,1) \in R$ and $8 \geq 1$ it is not symmetric. **Transitive:** $(10,3) \in R$ and $(3,2) \in R$ but (10,3) doesnot belongs to R Relation is not transitive.	3
16	**For reflexive**: Let a = $\frac{1}{2}$, (a, a) ϵ R ⇒ $\frac{1}{2} \leq (\frac{1}{2})^2$ ⇒ $\frac{1}{2} \leq \frac{1}{4}$, false, Hence, not reflexive. **For symmetric**: Let (-1, 2) ϵ R as $-1 \leq (2)^2$ is true. Now (2,-1) ϵ R ⇒ $2 \leq (-1)^2$ ⇒ 2≤1 is false. As (-1, 2) ϵ R ⇏ (2,-1) ϵ R, Hence, not symmetric. **For transitive**: Let (6,3),(3,2) ϵ R (6,3) ϵ R ⇒ $6 \leq (3)^2$ ⇒ 6 ≤ 9, true (3,2) ϵ R ⇒ $3 \leq (2)^2$ ⇒ 3 ≤ 4, true We have to show, (6, 2) ϵ R =>$6 \leq (2)^2$ => 6 ≤ 4, false. So, not transitive.	1 1 1
17	*Given, A = R−{3}, B = R−{1} and f(x) =* $\frac{x-2}{x-3}$. ***For one-one:*** *Let for* $x_1, x_2 \in A$, $f(x_1) = f(x_2) \Rightarrow \frac{x_1-2}{x_1-3} = \frac{x_2-2}{x_2-3}$ $\Rightarrow x_1x_2 - 2x_2 - 3x_1 + 6 = x_1x_2 - 3x_2 - 2x_1 + 6$ $\Rightarrow x_1 = x_2$	$1\frac{1}{2}$

	As $f(x_1) = f(x_2) \Rightarrow x_1 = x_2$. *Hence, function is one-one.* **<u>For onto</u>:** Let $y \in B$, there exists $x \in A$ such that $y = f(x) \Rightarrow y = \frac{x-2}{x-3}$ $\Rightarrow xy - 3y = x - 2$ $\Rightarrow xy - x = 3y - 2$ $\Rightarrow x(y-1) = 3y - 2$ $\Rightarrow x = \frac{3y-2}{y-1} \in A$. Hence, onto.	$1\frac{1}{2}$
18	**<u>For reflexive</u>***:* *For any* $a \in Z$, *we have* $a - a = 0$, *which is divisible by 5.* $\Rightarrow (a, a) \in R$ *Thus,* $(a, a) \in R$ *for all* $a \in A$. *So, R is reflexive.* **<u>For symmetric</u>**: *Let* $(a, b) \in R$. *Then,* $(a, b) \in R$ $\Rightarrow a - b$ *is divisible by 5* $\Rightarrow -(a - b)$ *is divisible by 5* $\Rightarrow b - a$ *is divisible by 5* $\Rightarrow (b, a) \in R$ *So, R is symmetric.* ***<u>For transitive</u>****: Let* $(a,b) \in R$ *and* $(b,c) \in R$, *for* $a, b, c \in Z$ $\Rightarrow (a-b)$ *is divisible by 5 and* $(b-c)$ *is divisible by 5* $\Rightarrow (a - b)+(b - c) = a-c$ *is divisible by 5* $\Rightarrow (a, c) \in R$ *As* $(a,b) \in R$ *and* $(b,c) \in R \Rightarrow (a,c) \in R$ *Hence, R is transitive.* *Since R is reflexive, symmetric and transitive* $\Rightarrow$ *R is equivalence relation.*	1 1 1

CLASS-XII
CHAPTER-01
RELATION AND FUNCTION
04 MARKS TYPE QUESTIONS

Q. No.	QUESTION	MARK
1	In two different societies, there are some school going students including girls as well as boys. Satish forms two sets with these students, as his college project. Let A= $\{a_{1,}\ a_{2,}\ a_{3,}a_{4,}\ a_{5,}\}$ and B =$\{b_{1,}b_{2,}b_{3,}\ b_{4,}\}$ where a_i's and b_i's are the school going students of first and second society respectively. Satish decides to explore these sets for various types of relations and functions. Using the information given above, answer the following :  (i) Satish wishes to know the number of relations defined in set A. How many such relations are possible? (ii) How many functions are possible from set A to set B? (iii) Among all possible functions from B to A, how many are injections? (iv) How many reflexive relations can be defined in set B?	4
2	In general election of Lok Sabha in 2019, about 911 million people were eligible to vote and voter turnout was about 67%, the highest ever. Let A be the set of all citizens of India who were eligible to exercise their voting right in general election held in 2019. A relation 'R' is defined on A as follows: R = {(V_1, V_2) :V_1, V_2 ∈A and both use their voting right in general election – 2019}  Read the above passage and answer the following questions. **(I)**. Mr.'X' and his wife 'W'both exercised their voting right in general election -2019, Which of the following is true? (A). (X,W) ∈ R but (W,X) ∉ R (B). (X,W) ∈ and (W,X) ∈ R (C). (X,W) ∉ R and (W,X) ∉ R (D). (W,X) ∈ R but (X,W) ∉ R **(II)**. Three friends F1, F2 and F3 exercised their voting right in general election-2019, then which of the following is true? (A). (F1,F2) ∈R, (F2,F3) ∈ R and (F1,F3) ∈ R (B). (F1,F2) ∈ R, (F2,F3) ∈ R and (F1,F3) ∉ R (C). (F1,F2) ∈ R, (F2,F2) ∈R but (F3,F3) ∉ R (D). (F1,F2) ∉ R, (F2,F3) ∉ R and (F1,F3) ∉ R	4

	(III). Mr. John exercised his voting right in General Election – 2019, then Mr. John is related to which of the following? (A). Eligible voters of India (B). Family members of Mr. John (C). All citizens of India (D). All those eligible voters who cast their votes **(IV).** The relation R = {(V_1, V_2) :V_1, V_2 ∈A and both use their voting right in general election – 2019} is ------- (A) symmetric but not reflexive (B) reflexive, symmetric but not transitive (C) equivalence relation (D) neither reflexive nor symmetric nor transitive	
3	Manikanta and Sharmila are studying in the same KendriyaVidyalaya inVisakhapatnam. The distance from Manikanta's house to the school is same as distance from Sharmila's house to the school. If the houses are taken as a set of points and KV is taken as origin, then answer the below questions based on the given information; (M for Manikanta's house and S for Sharmila's house)  i. The relation is given by { (Distance of point M from origin is same as distance of point S from origin } is a) Reflexive, Symmetric and Transitive b) Reflexive, Symmetric and not Transitive c) Neither Reflexive nor Symmetric d) Not an equivalence relation ii. Suppose Dheeraj's house is also at the same distance from KV then a) OM ≠ OS b) OM ≠ OD c) OS ≠ OD d) OM = OS= OD iii. If the distance from Manikanta, Sharmila and Dheeraj houses from KV are same, then the points form a a) Rectangle b) Square c) Circle d) Triangle	4

	iv. Let {(0,3),(0,0),(3,0)} , then the point which does not lie on the circle is a) (0,3) b) (0,0) c) (3,0) d) None of these	
4	Priya and Surya are playing monopoly in their house during COVID. While rolling the dice their mother Chandrika noted the possible outcomes of the throw every time belongs to the set { }. Let A denote the set of players and B be the set of all possible outcomes. Then { } { }.Then answer the below questions based on the given information-  Let be defined by {(}, then R is a) Equivalence relation b) Not Reflexive but symmetric, transitive c) Reflexive, Symmetric and not transitive d) Reflexive, transitive but not symmetric ii. Chandrika wants to know the number of functions for to. How many number of functions are possible? a) 6 2 b) 2 6 c) 6 d) 2 12 iii. Let be a relation on defined by {(1,1),(1,2),(2,2),(3,3),(4,4),(5,5),(6,6) }. Then is a) Symmetric b) Reflexive c) Transitive d) None of these Let be defined by Chandrika wants to know the number of relations for A to B . How many number of relations are possible? a) 6^2	4

	b) 2^6 c) 6 d) 2^{12}	
5	"When a computer reads a number, you type in, it converts the number to binary for internal storage, then it prints the number out again onto the screen that you see" – it's utilizing an inverse function. Explain? 	4
6	You work forty hours a week at a furniture store. You receive a \$220 weekly salary, plus a 3% commission on sales over \$5000. Assume that you sell enough this week to get the commission. Given the functions f (x) = 0.03x and g(x) = x − 5000, which of (f ∘ g) (x) and (g ∘ f) (x) represents your commission? 	4
7	Students of class 12, planned to plant saplings along straight lines, parallel to each other to one side of the school ground ensuring that they had enough play area. Let us assume that they planted one of the row of saplings along the line $2x + y = 6$. Let L be the set of all lines which are parallel on the ground and R be relation on L.  (1) 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) Check whether the function $f: R \to R$ defined by $f(x)$ =6-2x is bijective or not.	4
8	**Let** $f: w \to w$ be defined as $f(n) = \begin{cases} n+1; if\ n\ is\ even. \\ n-1; if\ n\ is\ odd. \end{cases}$ Show that f is One-One onto function.	4
9	Prove that a function f: $[0,\infty) \to [-5,\infty)$ be defined by f(x)= $4x^2$+4x-5 is bijective.	4

10	Show that the function f:R → $\{x \in R : -1 < x < 1\}$ defined by f(x) = $\frac{x}{1+\lvert x\rvert}$,x∈ R is one-one onto function.	4
11	Sherlin and Dhanju 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.  $A = \{S, D\}, B = \{1, 2, 3, 4, 5, 6\}$. Answer the following questions based on the given information: (i) Let $R: B \to B$ be defined by $R = \{(x, y): y \text{ is divisible by } x\}$. Verify that whether R is reflexive, symmetric and transitive. (ii) Raji wants to know the number of functions from A to B. Find the number of all possible functions. (iii) 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 R is which kind of relation? OR Raji wants to know the number of relations possible from A to B. Find the number of all possible relations.	4
12	Read the following passage and answer the following questions: Dhanush wants to take a test of his son Amit is a student of class XII. Dhanush said to Amit, "Observe the two functions f(x) and g(x) carefully" f: R → R and g: R → R such that f(x) = x and g(x) = x^2. Dhanush asked some questions related to f(x) and g(x) and Amit answered correctly. Write the correct response given by Amit of the following questions. (i) Check whether f(x) is bijective or not. (ii) Check whether f(x) is bijective or not.	4

ANSWER CHAPTER-01

RELATION AND FUNCTION 04 MARKS TYPE QUESTIONS

Q.No	**ANSWERS**	**Mark**
1	(i) 2^{25}relations are possible on A. (ii) 4^5 functions are possible from A to B (iii) 5_{P_4}=120 one-one functions from B to A. (iv)2^{12} reflexive relations are possible on B.	4
2	(I) (B). (X,W) ∈ and (W,X) ∈ R (II) (A). (F1,F2) ∈R, (F2,F3) ∈ R and (F1,F3) ∈ R (III) (D). All those eligible voters who cast their votes (IV) (C) equivalence relation	4
3	(i) A ii) D iii) C iv) B	4
4	(i) A ii) A iii)D iv)D	4
5	We all know that computer only reads binary numbers i.e., only 1 and 0. In order for the computers to read any alphabets, all the alphabets, including numbers, special characters were assigned with a number which we call as ASCII value. The ASCII value of a= 65 1=49 In binary form, a= 01000001 1= 00110001 Let us consider a function, f(x) = {x: x belongs to the set of alphabets, numbers, special character} g(x) = {y: y belongs to the set of binary numbers of alphabets, number, special character} According to the question, let the number of two function be: f(x) = {A, 1} g(x) = {01000001, 00110001} Let us consider the composition of function., So, (f ∘ g) (x) = f (g(x)) =f (01000001, 00110001) = f (01000001), f (00110001) = {A, 1} On the other hand, (g ∘ f) (x) = g (f (x)) = g (A, 1) = g(A), g (1) = {01000001, 00110001} We can see that, when we input alphabets to the computer (f(x)), the computer will read the data in binary form(g(x)) and the same alphabets will show in the screen. Similarly, when we inverse the process of inputting the information, we can see that while inputting the binary digit to the computer (g(x)), the computer will convert the digit into alphabets (f(x)) and then show the alphabets to the screen. Hence, even when we change the sequence of inserting the information, the result will be the same. This shows the inverse function.	4

6	Given the functions f (x) = 0.03x and g(x) = x − 5000 Well, (f ∘ g) (x) = f (g(x)) would mean that I would take my sales x, subtract off the $5000 that didn't get the commission, and then multiply whatever is left by 3%. i.e., (f ∘ g) (x) = f (g(x)) = f(x-5000) = 0.03* (x-5000) = 0.03* (220-5000) = 0.03* - 4780 = 143.4 On the other hand, (g ∘ f) (x) = g (f (x)) would mean that I would take my sales x, multiply by 3%, and then subtract $5000 from the result. Not only is this not how the commission is calculator, this could land me in negative numbers! i.e., (g ∘ f) (x) = g (f (x)) = g (0.03x) = 0.03*x - 5000 = 0.03 * 220 – 5000 = 6.6 – 5000 = - 4993.4 So (f ∘ g) (x) is the composition that does what I need it to do. Hence, (f ∘ g) (x) represents my commission.	4
7	Given relation R is defined by R={(L_1, L_2): $L_1 \parallel L_2$ where $L_1, L_2 \in$ L} **Reflexive:-** let $L_1 \in L$ since $L_1 \parallel L_1 \Rightarrow (L_1, L_1) \in$ R Hence R is reflexive relation. . **Symmetric:-** let $L_1, L_2 \in L$ and let $(L_1, L_2) \in R$ since $L_1 \parallel L_2 \Rightarrow L_2 \parallel L_1 \Rightarrow (L_2, L_1) \in$ R Hence R is symmetric relation **Transitive Relation:-** let $L_1, L_2, L_3 \in L$ and let $(L_1, L_2) \in R$ and $(L_2, L_1) \in$ R $\therefore$ $L_1 \parallel L_2$ and $L_2 \parallel L_3$ $\Rightarrow L_1 \parallel L_3 \Rightarrow (L_1, L_3) \in$ R ∴ R is Transitive relation .∵ R is Reflexive Symmetric and Transitive relation. ∴ R is Equivalence relation. (1) (***b***) Given Function $f: R \to R$ defined by $f(x) = 6 - 2x$. $\boldsymbol{Injective}: -$ Let $x_1, x_2 \in$ R such that $x_1 \neq x_2$ $\Rightarrow\ 6 - 2x_1 \neq 6 - 2x_2 \ \Rightarrow\ f(x_1) \neq f(x_2)$ ∴ f is injective. $\boldsymbol{Sujective}: -$ Let y=$6 - 2x$ $\Rightarrow$ x =$\frac{6-y}{\mathbf{2}}$ $for\ every\ y\ \in R\ (co-domain)\ \ there\ exist$ x=$\frac{6-y}{2}$ $(co-domain)$ ie co-domain =Range ∴ f is Surjective. (2) ∴ f is Bijective function.	4
8	**. One-One function** Let x,y ∈ W	4

	If x and y both are even number then $f(x) = f(y)$ Or x+1=y+1 or x=y If x and y both are odd number then x-1 = y-1 or x=y If x is odd and y is even ie .$x \neq y, x-1\ is\ even\ , y+1\ is\ odd\ x \neq y$ or $f(x) \neq f(y)$ similarly x is even and y is odd .f is one-one function. **Onto function Range of f={** $f(0), f(1), f(2), \ldots \ldots.$} ={1,0,3,2,…….}=Co-domain. ∴ **f** is onto function	
9	**One-One** Let $x_1, x_2 \in [0,\infty)$ such that $x_1 \neq x_2$ $4x_1^2+4x_1-5 = 4x_2^2+4x_2-5$ $x_1 = x_2$ therefore f is one one **onto :** $x \in [0,\infty)$ $4x^2+4x-5 \geq -5$ $F(x) \geq -5$ $R(f) = [-5, \infty)$ F is onto, f is bijective.	4
10	$f(x) = \frac{x}{1+\|x\|} = \begin{cases} \frac{x}{1+x} & if\ x \geq 0 \\ \frac{x}{1-x} & if\ x < 0 \end{cases}$ **two cases arise**: **(i) x≥0** $y = \frac{x}{1+x}$ $x = y\ ; f\ is\ one\ one$ $\frac{x}{1+x} \geq 0$ $x = \frac{y}{1-y} \geq 0$ such that f(x)=y $f\ is\ onto$ (ii) x<0 Now we will prove it similarly as above.	4
11	(i) Given $R: B \to B$ be defined by $R = \{(x,y): y\ is\ divisible\ by\ x\}$. **Reflexive:** Let $x \in B$, since x is always divisible by x itself. Therefore $(x,x) \in R$ It is reflexive.	1

Symmetric: Let $x, y \in B$ and $(x, y) \in R$

$\Rightarrow y$ is divisible by x

$\Rightarrow \frac{y}{x} = k_1$, where k_1 is an integer

$\Rightarrow \frac{x}{y} = \frac{1}{k_1} \neq$ integer.

$\therefore (y, x) \notin R$

It is not symmetric.

Transitive: Let $x, y, z \in B$ and

let $(x, y) \in R \Rightarrow \frac{y}{x} = k_1$, where k_1 is an integer

and $(y, z) \in R \Rightarrow \frac{z}{y} = k_2$, where k_2 is an integer

$\therefore \frac{y}{x} \times \frac{z}{y} = k_1 . k_2 = k$ (integer)

$\Rightarrow \frac{z}{x} = k \Rightarrow (x, z) \in R$

It is transitive.

Hence, relation is reflexive and transitive but not symmetric.

(ii) We have,

$A = \{S, D\} \Rightarrow n(A) = 2$ — 1

and $B = \{1, 2, 3, 4, 5, 6\} \Rightarrow n(B) = 6$

$\therefore$ Number of functions from A to $B = 6^2 = 36$.

(iii) Given R be a relation on B defined by

$R = \{ (1,2), (2,2), (1,3), (3,4), (3,1), (4,3), (5,5)\}$. — 2

Reflexive: R is not reflexive since $(1,1), (3,3), (4,4) \notin R$.

Symmetric: R is not symmetric since $(1,2) \in R$ but $(2,1) \notin R$.

Transitive: R is not transitive as $(1,3) \in R$ *and* $(3,1) \in R$

but $(1,1) \notin R$.

$\therefore R$ is neither reflexive nor symmetric nor transitive.

OR

Since $n(A) = 2$ and $n(B) = 6 \Rightarrow n(A \times B) = 12$.

$\therefore$ Total number of possible relations from A to $B = 2^{12}$. — 2

12 (i) We have $f: R \rightarrow R$ such that f(x) = x

One-One: Let $x_1, x_2 \in R$ (domain) such that — 1

$f(x_1) = f(x_2) \Rightarrow x_1 = x_2$

	$\Rightarrow$ f is one-one.	1
	Onto: Let $y \in R$ (co-domain) such that $f(x) = y \Rightarrow x = y$	
	Now f(x) = f(y) = y.	
	So for y ∈ R (co-domain), there exists x = y ∈ R (domain) such that f(x) = y.	
	$\Rightarrow$ f is onto.	
	As f is one-one and onto $\Rightarrow f$ is bijective.	
	(ii) We have $g: R \to R$ such that $g(x) = x^2$	
	One-One: Since $1, -1 \in R$ (domain) such that	1
	$g(1) = 1$ and $g(-1) = 1$	
	Therefore $g(1) = g(-1)$ but $1 \neq -1$	
	$\Rightarrow g$ is not one-one.	
	Onto: Since $g(x) = x^2 \geq 0$ for all $x \in R$	1
	Range of g = $[0, \infty) \neq$ R (co-domain)	
	$\Rightarrow g$ is not onto.	
	As g is neither one-one nor onto $\Rightarrow g$ is not bijective.	

CLASS-XII

CHAPTER-01

RELATION AND FUNCTION

05 MARKS TYPE QUESTIONS

Q. No.	QUESTION	MARK
1.	Two integers a and b are said to be **congruence modulo m** if a-b is divisible by m which is as $a \equiv b(m)$. Show that the relation $a \equiv b(5)$ on the set **Z** of all integers is an equivalence relation. Also find equivalence class [2].	5
2.	Consider a function $f: R \rightarrow R$ defined by $f(x) = x^2 + 5x - 7$. Check whether f is one-one or onto or both. If not, then what will be the domain and co-domain show that f will be bijective?	5
3.	If A = R-{3} and B = R-{1}. Consider the function f: A→B defined by f(x) x-2/ x-3 for all x∈A. Then show that f is bijective.	5
4.	If Z is the set of all integers and R is the relation on Z defined as R = {(a, b):a,b ∈ Z and a – b is divisible by 5}. Prove that R is an equivalence relation	5
5.	If we throw two dices, the total number of possible outcomes is 36. Show how it is an equivalence relation.	5
6.	Let A = R -{3} and B = R – {1}. Consider the function f: A →B defined by f (x) = (x- 2)/ (x -3). Is f one-one and onto? Justify your answer.	5
7.	Prove that the relation in the set **A={**1,2,3,4,5} given by **R**={(a,b):$\|a-b\|$ is an even} is an equivalence relation	5
8.	Kendriya Vidyalaya Sangathan conducted cycle race under two different categories- Boys and Girls. There were 32 participants in all. Among all them, finally three from category -1 and two from category-2 were selected for the final race. Amit form two sets B and G with these participants form 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.  (A) How many relation from B to G ? (B) Among all the possible relations from B to G, how many functions can be formed from B to G?	5

	A function $f: B \to G$ be defined by $f: B \to G$ defined by f={(b_1, g_1), (b_2, g_2),($b_3, g_1)$}.Check f is bijective or not ?	
9.	Show that the relation R on the set A={ $x \epsilon Z$,$0 \leq x \leq 12$} ,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 i.e. equivalence class [1].	5
10.	A function f:[-4,4] →[0,4] is given by f(x) =$\sqrt{16 - x^2}$, show that f is a onto function but not one-one. Find all possible values of "a" for which f(x)=$\sqrt{7}$	5
11.	Let R be the relation in N × N $defined\ by\ (a, b)\ R\ (c, d)$. If $a + d = b + c$ for $(a, b), (c, d)$ in $N \times N$. Prove that R is an equivalence relation.	5
12.	Show that $f : N \to N$ is given by $f(x) = \begin{cases} x+1, & if\ \ x\ is\ odd \\ x-1, & if\ \ x\ is\ even \end{cases}$ is bijective (both one-one and onto).	5

ANSWER
CHAPTER-01
RELATION AND FUNCTION
05 MARKS TYPE QUESTIONS

Q.No	ANSWERS	Mark
1.	Reflexive: For every integer $x,\ x - x = 0$ is divisible by 5. So $x \equiv x(mod\ 5)$. Therefore the relation **congruence modulo 5** is reflexive**.** Symmetric: Let $x \equiv y\ (mod\ 5)$ then $x - y$ is visible by 5. Let $x - y = 5k$, Then $y - x = -5k$ which is also divisible by 5. Hence $y \equiv x\ (mod\ 5)$. Therefore the relation **congruence modulo 5** is symmetric Transitive: Assume that $x \equiv y\ (mod\ 5)$ and $y \equiv z\ (mod\ 5)$. $\Rightarrow x - y = 5k$ and $y - z = 5l.$ $\Rightarrow x - z = (x - y) + (y - z) = 5(k + l)$ is also divisible by 5. Hence $x \equiv z\ (mod\ 5)$. Therefore the relation **congruence modulo 5** is symmetric As congruence modulo 5 is reflexive, symmetric and transitive, so it is an equivalence relation.	5
2.	$f(x) = x^2 + 5x - 7$. Check whether f is one-one or onto or both. If not, then what will be the domain and co-domain show that f will be bijective? For Injective: let $x_1, x_2 \in R$ and $f(x_1) = f(\ x_2)$ $\Rightarrow {x_1}^2 + 5x_1 - 7 = {x_2}^2 + 5x_2 - 7$ $\Rightarrow {x_1}^2 - {x_2}^2 + 5x_1 - 5x_2 = 0$ $\Rightarrow (x_1 - x_2)(x_1 - x_2 + 5) = 0$ $\Rightarrow (x_1 - x_2) = 0\ or\ (x_1 + x_2 + 5) = 0$ $\Rightarrow x_1 = x_2 \quad or \quad x_1 = x_2 - 5$ There fore f is not one-one. To be one-one $x_1 + x_2 + 5$ should not be zero. It will happen only when $x_1, x_2 \in [0, \infty)$. So to be injective, Domain must be $[0, \infty)$. For Surjective: Let $x^2 + 5x - 7 = y$ $\Rightarrow x^2 + 5x - 7 - y = 0$ $\Rightarrow\ x = \frac{-5 \pm\sqrt{25+4(y+7)}}{2}$ To be onto $x = \frac{-5 \pm\sqrt{25+4(y+7)}}{2} \geq 0$ $\Rightarrow \sqrt{25 + 4(y + 7)}\ \geq 5$ $\Rightarrow y \geq -7$ Range = $[-7,\ \infty) \neq$ Co-domain. So f is not onto. Therefore, f will be surjective if Co-domain=Range= $[-7,\ \infty)$ So, f will be bijective if domain is $[0,\ \infty)$ and Co-domain is $[-7,\ \infty)$.	5

3.	Given, function is f: $A \rightarrow B$, where $A = R-\{3\}$ and $B=R-\{1\}$, such that $f(x)= x-2/x-3$. For One-one Let $f(x1) = f(x2)$, for all $x1, x2 \in A$ $\Rightarrow x2-2/ x1-3= x2-2/ x2-3$ $\Rightarrow (x1 - 2) (x2-3) = (x1-2)(x? - 3)$ $\Rightarrow x1x2 - 3x1 -2x2 + 6 = x1x2 - 3x1 - 2x2 +6$ $\Rightarrow - 3x12x2 = - 3x1 - 2x2$ $- 3 (x1 - x2)+2 (x1 - x2) = 0$ $- (x1 - x2) = 0$ Or, $x1 - x2= 0$ This implies, $x1 = x2$. Since, $f(x1) = f(x2)$ $\Rightarrow x1 = x2$, for all $x1, x2 \in A$. So, f(x) is a one-one function. Onto To show f(x) is onto, we show that range of f(x) and its codomain are same. Now, let. $y =x-2 /x - 3$ or, $xy-3y=x-2$ $\Rightarrow xy - x = 3y - 2$ $\Rightarrow x(y-1) = 3y - 2$ $\Rightarrow x=3y-2/y-1$ ……Eqn (1) Since, $x \in R-\{3\}$, for all $y \in R- \{1\}$, the range of $f(x)=R-\{1\}$.	5

	Also, the given codomain of f(x) = R-{1} Therefore, Range = Codomain. Hence, f(x) is an onto function. Therefore, f(x) is a bijective function.	
4.	The given relation is R = {(a, b): a, b ∈ Z and a − b is divisible by 5}. To prove R is an equivalence relation, we have to prove R is reflexive, symmetric and transitive. Reflexive: As for any x ∈ Z, we have x − x = 0, which is divisible by 5. ⇒ (x − x) is divisible by 5. ⇒ (x, x) ∈ R, V x ∈ Z Therefore, R is reflexive. Symmetric: Let (x, y) ∈ R, where x, y ∈ Z. ⇒ (x − y) is divisible by 5. [by definition of R] ⇒ x − y = 5A for some A ∈ Z. ⇒ y − x = 5(−A) ⇒ (y − x) is also divisible by 5. ⇒ (y, x) ∈ R Therefore, R is symmetric. Transitive: Let (x, y) ∈ R,where x, y ∈ Z. ⇒ (x − y) is divisible by 5. ⇒ x − y = 5Afor some A ∈ Z Again, let (y, z) ∈ R, where y, z ∈ Z. ⇒ (y − 1) is divisible by 5. ⇒ y − z = 5B for some B ∈ Z. Now, (x – y) + (y – 2) = 5A + 5B ⇒ x – z = 5(A + B) ⇒ (x – z) is divisible by 5 for some (A + B) ∈ Z ⇒ (x, z) ∈ R Therefore, R is transitive. Thus, R is reflexive, symmetric and transitive. Hence, it is an equivalence relation	5
5.	If we note down all the outcomes of throwing two dices, we get the following possible relations:	5

	R = {(1,1), (2,2), (3,3), (1,2), (2,3), (3,4), ………)} Reflexive: For the relation to be reflexive (a, a) $\in$ R for all a$\in$ R Since, (1,1), (2,2), (3,3), ……. $\in$ R Hence, the relation is reflexive. <u>Symmetric:</u> For the relation to be symmetric (a, b) $\in$ R => (b, a) $\in$ R for all a, b$\in$ R In this relation, (1,2) $\in$ R => (2,1) $\in$ R (2,3) $\in$ R => (3,2) $\in$ R (3,4) $\in$ R => (4,3) $\in$ R . Hence, it satisfies the condition of symmetric. Hence, the function is symmetric. <u>Transitive:</u> For the relation to be transitive (a, b) $\in$ R and (b, c) $\in$ R (a, c) $\in$ R for all a, b, c $\in$ R In this relation, (1,2) $\in$ R & (2,3) $\in$ R => (1,3) $\in$ R (2,3) $\in$ R & (3,2) $\in$ R => (2,2) $\in$ R (4,5) $\in$ R & (5,2) $\in$ R => (4,2) $\in$ R . . . Hence, it satisfies the condition of transitivity. Hence, the relation is transitive. Since, the relation R is reflexive, symmetric as well as transitive, the relation R is equivalence relation. Hence, throwing two dices is an example of equivalence relation.	
6.	Given function: $f(x) = (x-2)/(x-3)$ Checking for one-one function: $f(x1) = (x1-2)/(x1-3)$ $f(x2) = (x2-2)/(x2-3)$ Putting $f(x1) = f(x2)$ $(x1-2)/(x1-3) = (x2-2)/(x2-3)$ $(x1-2)(x2-3) = (x1-3)(x2-2)$ $x1(x2-3) - 2(x2-3) = x1(x2-2) - 3(x2-2)$ $x1\,x2 - 3x1 - 2x2 + 6 = x1\,x2 - 2x1 - 3x2 + 6$ $-3x1 - 2x2 = -2x1 - 3x2$ $3x2 - 2x2 = -2x1 + 3x1$ $x1 = x2$ Hence, if $f(x1) = f(x2)$, then $x1 = x2$ Thus, the function f is one-one function. Checking for onto function:	5

	f (x) = (x-2)/(x-3) Let f(x) = y such that y B i.e., y ∈ R – {1} So, y = (x -2)/ (x- 3) y (x -3) = x- 2 xy -3y = x -2 xy – x = 3y-2 x (y -1) = 3y- 2 x = (3y -2) /(y-1) For y = 1, x is not defined but it is given that. y ∈ R – {1} Hence, x = (3y- 2)/ (y- 1) ∈ R - {3} Hence, f is onto.	
7.	The given relation in the set **A={**1,2,3,4,5} given by **R**={(a,b):$\lvert a-b\rvert$ is an even}. **Reflexive:-** As $\lvert x-x\rvert$=0 is even $\forall\ x \in A$ Hence R is reflexive relation (1) **Symmetric Relation:-** Let (x,y) ∈ R ⇒ $\lvert x-y\rvert$ is even (by definition of given relation ⇒ $\lvert y-x\rvert$ is also even since $\lvert a\rvert = \lvert -a\rvert\ \forall\ a \in A$ ⇒ (y,x) ∈ R $\forall\ x, y \in A$ ∴ R is symmetric relation. ($1\frac{1}{2}$) **Transitive Relation:-** Let (x,y) ∈ R and (y,z) ∈ R ⇒ $\lvert x-y\rvert$ is even (by definition of given relation ⇒ $x-y=\pm 2l$ (l is an integer)……….(1) ⇒ $\lvert y-z\rvert$ is even (by definition of given relation ⇒ $y-z=\pm 2m$(m is an integer)………(2) Add equation(1) and equation(2) $(x-y)$+($y-z$)= $\pm 2l \pm 2m$== $\pm 2k$ is an integer . ⇒ $x-z=\pm 2k$ ⇒ $\lvert x-z\rvert$ is an even integer number . (2) ⇒ (x,z) ∈ R ∴ R is transitive relation.	5
8.	**B=**{$b_1, b_2 b_3$} **G**=={g_1, g_2} n(B)=3 n(G)=2 **since** n(B× G) = n(B)×n(G)=3× 2 (1) (A) Number of relation from B to G=2^6 (1) (B) Number of functions from B to G=$2^{n(B\times G)}$ $=[n(G)]^{n(B)} = 2^3$=8 (1) (C) f={(b_1, g_1), (b_2, g_2),(b_3, g_1)}. Since $f(b_1)=g_1$ and $f(b_3)=g_1$ ⇒ $f(b_1)=f(b_3)$ but $(b_1) \neq (b_3)$ $As\ b_1 and\ b_1$ represents two different boys. ⇒ f is not one-one. ⇒ f is not bijective map. (2)	5

<table>
<tr><td>9.</td><td>Reflexivity:
For a $\in A$, we have
|a-a| =0, which is a multiple of 4
R is reflexive.
<u>Symmetric</u>
Let (a,b) $\in R$
|a-b| is a multiple of 4
|b-a| will also multiple of 4
(b,a) $\in R$
R is symmetric.
<u>Transitive:</u>
Let (a,b) ,(b,c) $\in R$
|a-b| is a multiple of 4
|a-b| =4λ , a-b= $\pm 4\lambda$
|b-c| is a multiple of 4
|b-c| =4μ , b-c= $\pm$4μ
Therefore a-c= $\pm 4 \pm$ 4μ
(a,c) $\in R$
R is transitive.
For equivalence class:
|x-1|= 0,4,8,12
X=1,5,9</td><td>5</td></tr>
<tr><td>10.</td><td>y =$\sqrt{16-x^2}$
y^2= $16-x^2$
x =$\sqrt{16-y^2}$
clearly for x to be x$\in [-4,4]$
$16-y^2 \geq 0$
(y-4) (y+4)$\leq$ 0
$0 \leq y \leq 4$
Therefore it is onto
When x=4 , y=0
When x=-4 ,y=0
So it is not one one
Also—
F(a)= $\sqrt{7}$
$\sqrt{16-a^2}$ = $\sqrt{7}$
$16-a^2=7$
a$\in [-3,3]$</td><td>5</td></tr>
<tr><td>11.</td><td>For Reflexive
(a, b) R (a, b) ⇒ a + b = b + a which is true since addition is commutative on N.
⇒ R is reflexive.
For Symmetric
Let (a, b) R (c, d) ⇒ a + d = b + c
⇒ b + c = a + d
⇒ c + b = d + a
⇒ (c, d) R (a, b)</td><td>1

2</td></tr>
</table>

	$\Rightarrow$ R is symmetric. **For Transitive** for (a, b), (c, d),(e, f) in N × N Let (a, b) R (c, d) and (c, d) R (e, f) $\Rightarrow a + d = b + c$ and $c + f = d + e$ $\Rightarrow (a + d) – (d + e) = (b + c) – (c + f)$ $\Rightarrow a - e = b - f \Rightarrow a + f = b + e$ $\Rightarrow$ (a, b) R (e, f) $\Rightarrow$ R is transitive. Hence, R is an equivalence relation.	2
12.	**One-One**: Suppose $f(x_1) = f(x_2)$. **Case 1**: When x_1 is odd and x_2 is even. In this case $f(x_1) = f(x_2) \Rightarrow x_1 + 1 = x_2 - 1 \Rightarrow x_2 - x_1 = 2$ This is a contradiction, since the difference between an even natural number and an odd natural number can never be 2. Thus in this case $f(x_1) \neq f(x_2)$. Similarly, When x_1 is even and x_2 is odd, then $f(x_1) \neq f(x_2)$. **Case 2**: When x_1 and x_2 are both odd. In this case $f(x_1) = f(x_2) \Rightarrow x_1 + 1 = x_2 + 1 \Rightarrow x_1 = x_2$ $\therefore$ f is one-one. **Case 3**: When x_1 and x_2 are both even. In this case $f(x_1) = f(x_2) \Rightarrow x_1 - 1 = x_2 - 1 \Rightarrow x_1 = x_2$ $\therefore$ f is one-one. **Onto**: Let $y \in N\ (codomain)$. **Case 1**: When y is odd then $y + 1$ is even. $\therefore f(y + 1) = (y + 1) - 1 = y$ **Case 2**: When y is even then $y - 1$ is odd. $\therefore f(y - 1) = (y - 1) + 1 = y$. Thus each $y \in N\ (codomain)$has its pre-image in dom(f). $\therefore f$ is onto. Hence f is both one-one and onto (bijective).	1 1 1 1 1

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