

**UNIT TEST -1**  
**RELATIONS AND FUNCTIONS**

Time: 3 hrs

Marks : 100

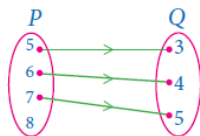
**I. Answer all the questions**

1x14=14

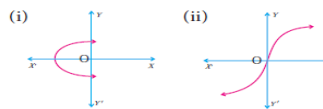
1. If  $n(A \times B) = 6$  and  $A = \{1, 3\}$  then  $n(B)$  is (a) 1 (b) 2 (c) 3 (d) 6
2.  $A = \{a, b, p\}$ ,  $B = \{2, 3\}$ ,  $C = \{p, q, r, s\}$  then  $n[(A \cup C) \times B]$  is (a) 8 (b) 20 (c) 12 (d) 16
3. If  $A = \{1, 2\}$ ,  $B = \{1, 2, 3, 4\}$ ,  $C = \{5, 6\}$  and  $D = \{5, 6, 7, 8\}$  then state which of the following statement is true (a)  $(A \times C) \subset (B \times D)$  (b)  $(B \times D) \subset (A \times C)$  (c)  $(A \times B) \subset (A \times D)$  (d)  $(D \times A) \subset (B \times A)$
4. If there are 1024 relations from a set  $A = \{1, 2, 3, 4, 5\}$  to a set  $B$ , then the number of elements in  $B$  is (a) 3 (b) 2 (c) 4 (d) 8
5. The range of the relation  $R = \{(x, x^2) / x \text{ is a prime number less than } 13\}$  is (a)  $\{2, 3, 5, 7\}$  (b)  $\{2, 3, 5, 7, 11\}$  (c)  $\{4, 9, 25, 49, 121\}$  (d)  $\{1, 4, 9, 25, 49, 121\}$
6. If  $\{(a, 8), (6, b)\}$  represents an identity function then the value of  $a$  and  $b$  are respectively (a) (8, 6) (b) (8, 8) (c) (6, 8) (d) (6, 6)
7. Let  $n(A) = m$  and  $n(B) = n$  then the total number of non-empty relations that can be defined from  $A$  to  $B$  is (a)  $m^n$  (b)  $n^m$  (c)  $2^{mn} - 1$  (d)  $2^{mn}$
8. If the ordered pairs  $(a + 2, 4)$  and  $(5, 2a + b)$  are equal then  $(a, b)$  is (a) (2, -2) (b) (5, 1) (c) (2, 3) (d) (3, -2)
9. Let  $f(x) = \sqrt{1 + x^2}$  then (a)  $f(xy) = f(x) \cdot f(y)$  (b)  $f(xy) \geq f(x) \cdot f(y)$  (c)  $f(xy) \leq f(x) \cdot f(y)$  (d) None of these
10. If  $f : A \rightarrow B$  is a bijective function and if  $n(B) = 7$ , then  $n(A)$  is equal to (a) 7 (b) 49 (c) 1 (d) 14
11. If  $g = \{(1, 1), (2, 3), (3, 5), (4, 7)\}$  is a function given by  $g(x) = \alpha x + \beta$  then the values of  $\alpha$  and  $\beta$  are (a) (-1, 2) (b) (2, -1) (c) (-1, -2) (d) (1, 2)
12. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{4, 8, 9, 10\}$ . A function  $f : A \rightarrow B$  given by  $f = \{(1, 4), (2, 8), (3, 9), (4, 0)\}$  is a (a) Many-one function (b) identity function (c) one-to-one function (d) into function
13. Let  $f$  and  $g$  be two functions given by  $f = \{(0, 1), (2, 0), (3, -4), (4, 2), (5, 7)\}$   $g = \{(0, 2), (1, 0), (2, 4), (-4, 2), (7, 0)\}$  then the range of  $f \circ g$  is (a)  $\{0, 2, 3, 4, 5\}$  (b)  $\{-4, 1, 0, 2, 7\}$  (c)  $\{1, 2, 3, 4, 5\}$  (d)  $\{0, 1, 2\}$
14. If  $f(x) = 2x^2$  and  $g(x) = \frac{1}{3x}$ , then  $f \circ g$  is (a)  $\frac{3}{2x^2}$  (b)  $\frac{2}{3x^2}$  (c)  $\frac{2}{9x^2}$  (d)  $\frac{1}{6x^2}$

**II. Answer any 10 questions. Question No.28 is Compulsory**

10x2=20

15. If  $A \times B = \{(3, 2), (3, 4), (5, 2), (5, 4)\}$  then find  $A$  and  $B$
16. If (i)  $A = \{2, -2, 3\}$ ,  $B = \{1, -4\}$  (ii)  $A = \{m, n\}$ ,  $B = \phi$  then find  $A \times B$  and  $B \times A$
17.  The diagram shows a relationship between the sets P and Q. write the relation in (i) Set builder form (ii) Roster form (iii) What is the domain and range of R.
18. Let  $A = \{1, 2, 3, 4, \dots, 45\}$  and  $R$  be the relation defined as "is square of" on  $A$ . Write  $R$  as a sub set of  $A \times A$ . Also, find the domain and range of  $r$
19. A relation  $R$  is given by the set  $\{(x, y) | y = x + 3, x \in \{0, 1, 2, 3, 4, 5\}\}$ . Determine its domain and range
20. Let  $X = \{1, 2, 3, 4\}$  and  $Y = \{2, 4, 6, 8, 10\}$  and  $R = \{(1, 2), (2, 4), (3, 6), (4, 8)\}$  Show that  $R$  is a function and find its domain, co-domain and range?
21. A relation 'f' is defined by  $f(x) = x^2 - 2$  where,  $x \in \{-2, -1, 0, 3\}$  (i) List the elements of  $f$  (ii) Is  $f$  a function?
22. Let  $A = \{1, 2, 3\}$ ,  $B = \{4, 5, 6, 7\}$  and  $f = \{(1, 4), (2, 5), (3, 6)\}$  be a function from  $A$  to  $B$ . Show that  $f$  is one-one but not onto function.
23. Let  $f$  be a function from  $R$  to  $R$  defined  $f(x) = 3x - 5$ . Find the values of  $a$  and  $b$  given that  $(a, 4)$  and  $(1, b)$  belong to  $f$

24. Determine whether the graph given below represent functions.  
Give reason



25. Re present the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$  through  
(i) an arrow diagram (ii) a table form (iii) a graph

26. Let  $A = \{1, 2, 3, 4\}$  and  $B = N$ . Let  $f : A \rightarrow B$  be defined by  $f(x) = x^3$  then (i) find the range of  $f$  (ii) identify the type of function

27. Find  $k$  if  $f \circ f(k) = 5$  where  $f(k) = 2k - 1$

28. Find  $f \circ g$  and  $g \circ f$  when  $f(x) = 2x + 1$  and  $g(x) = x^2 - 2$

### III. Answer any 10 questions. Question No.42 is Compulsory.

10x5=50

29. Let  $A = \{x \in N / 1 < x < 4\}$ ,  $B = \{x \in W / 0 \leq x < 2\}$  and  $C = \{x \in N / x < 3\}$  then verify that  $A \times (B \cup C) = (A \times B) \cup (A \times C)$

30. Given  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 5\}$ ,  $C = \{3, 4\}$  and  $D = \{1, 3, 5\}$ , check if  $(A \cap C) \times (B \cap D) = (A \times B) \cap (C \times D)$  is true?

31. Let  $A = \{3, 4, 7, 8\}$  and  $B = \{1, 7, 10\}$ . which of the following sets are relations from  $A$  to  $B$ ?

(i)  $R_1 = \{(3, 7), (4, 7), (7, 10), (8, 1)\}$  (ii)  $R_2 = \{(3, 1), (4, 12)\}$  (iii)  $R_3 = \{(3, 7), (4, 10), (7, 7), (7, 8), (8, 11), (8, 10)\}$

32. A company has four categories of employees given by Assistants (A), Clerks (C), Managers (M) and an Executive officer (E).

the company provide Rs.10,000, Rs.25000, Rs.50000 and Rs.100000 as salaries to the people who work in the categories A, C, M and A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub> and C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub> were Clerks M<sub>1</sub>, M<sub>2</sub>, M<sub>3</sub> were managers and E<sub>1</sub>, E<sub>2</sub> were Executive officers and if the relation

R is defined by  $xRy$ , where  $x$  is the salary given to person  $y$ , express the relation  $R$  through hand order pair and an arrow diagram.

33. If  $X = \{-5, 1, 3, 4\}$  and  $Y = \{a, b, c\}$ , then which of the following relations are functions from  $X$  to  $Y$ ?

(i)  $R_1 = \{(-5, a), (1, a), (3, b)\}$  (ii)  $R_2 = \{(-5, b), (1, b), (3, a), (4, c)\}$  (iii)  $R_3 = \{(-5, a), (1, a), (3, b), (4, c), (1, b)\}$

34. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{2, 5, 8, 11, 14\}$  be two sets. Let  $f : A \rightarrow B$  be a function given by  $f(x) = 3x - 1$ . Re present this function

(i) by arrow diagram (ii) in a table form (iii) as a set of ordered pairs (iv) in a graphical form

35. Let  $f$  be a function  $f : N \rightarrow N$  be defined by  $f(x) = 3x + 2, x \in N$

(i) Find the images of 1, 2, 3 (ii) Find the pre-images of 29, 53 (iii) identify the type of function

36. If the function  $f : R \rightarrow R$  is defined by  $f(x) = \begin{cases} 2x + 7; & x < -2 \\ x^2 - 2; & -2 \leq x < 3 \\ 3x - 2; & x \geq 3 \end{cases}$

(i)  $f(4)$  (ii)  $f(-2)$  (iii)  $f(4) + 2f(1)$  (iv)  $\frac{f(1) - 3f(4)}{f(3)}$

37. If the function  $f$  is defined by  $f(x) = \begin{cases} x + 2; & x > 1 \\ 2; & -1 \leq x \leq 1 \\ x - 1; & -3 < x < -1 \end{cases}$

(i)  $f(3)$  (ii)  $f(0)$  (iii)  $f(-1.5)$  (iv)  $f(2) + f(-2)$

38. The distance  $S$  an object travels under the influence of gravity in time  $t$  seconds is given by  $S(t) = \frac{1}{2}gt^2 + at + b$

where, ( $g$  is the acceleration due to gravity),  $a, b$  are constants. Verify whether the function

$S(t)$  is one-to-one or not.

39. The function  $t$  which maps temperature in Celsius ( $C$ ) into temperature in Fahrenheit ( $F$ ) is defined by  $t(C) = F$

where  $F = \frac{9}{5}C + 32$ . Find, (i)  $t(0)$  (ii)  $t(28)$  (iii) the value of  $C$  when  $t(C) = 212$

40. If  $f(x) = 2x + 3$ ,  $g(x) = 1 - 2x$  and  $h(x) = 3x$ . Prove that  $f \circ (g \circ h) = (f \circ g) \circ h$

41. Find  $x$  if  $gff(x) = fgg(x)$ , given  $f(x) = 3x + 1$  and  $g(x) = x + 3$ .

42. Let  $f : A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1, (-2)$  Where  $A = \{2, 4, 6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$  Re present  $f$  by

(i) by arrow diagram (ii) in a table form (iii) as a set of ordered pairs (iv) a graph

### IV. Answer following questions

2x8=16

43. Construct a triangle similar to a given triangle  $PQR$  with its sides equal to  $\frac{3}{5}$

of the corresponding sides of the triangle  $PQR$  (scale factor  $\frac{3}{5} < 1$ )

44. 

Diameter(x) cm	1	2	3	4	5
Circumference(y)cm	3.1	6.2	9.3	12.4	15.5

  
Draw a graph and find circumference of a circle when its diameter is 6cm