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Place: Kattuputhur, Trichy (Dt)

Exam Time : 03:00:00 Hrs

Total Marks : 100

15 x 1 = 15

**I. ANSWER ALL QUESTIONS**

- 1)  $A = \{a,b,p\}$ ,  $B = \{2,3\}$ ,  $C = \{p,q,r,s\}$  then  $n[(A \cup C) \times B]$  is  
 (a) 8    (b) 20    (c) 12    (d) 16
- 2) 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
- 3) If  $n(A \times B) = 6$  and  $A = \{1,3\}$  then  $n(B)$  is  
 (a) 1    (b) 2    (c) 3    (d) 6
- 4) 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)  $(D \times A) \subset (B \times A)$
- 5) 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)  $(3,-2)$
- 6) The range of the relation  $R = \{(x, x^2) \mid x \text{ is a prime number less than } 13\}$  is  
 (a)  $\{2,3,5,7\}$     (b)  $\{2,3,5,7,11\}$     (c)  $\{4,9,25,49,121\}$     (d)  $\{1,4,9,25,49,121\}$
- 7) 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)  $(6,6)$
- 8) 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)  $2^{mn}$
- 9) Let  $A = \{1, 2, 3, 4\}$  and  $B = \{4, 8, 9, 10\}$ . A function  $f: A \rightarrow B$  given by  $f = \{(1, 4), (2, 8), (3, 9), (4,10)\}$  is a  
 (a) Many-one function    (b) Identity function    (c) One-to-one function    (d) Into function
- 10) 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)  $\frac{1}{6x^2}$
- 11) 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
- 12) 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)  $\{0,1,2\}$
- 13) If  $g = \{(1,1), (2,3), (3,5), (4,7)\}$  is a function given by  $g(x) = ax + \beta$  then the values of  $a$  and  $\beta$  are  
 (a)  $(-1,2)$     (b)  $(2,-1)$     (c)  $(-1,-2)$     (d)  $(1,2)$
- 14)  $f(x) = (x + 1)^3 - (x - 1)^3$  represents a function which is  
 (a) linear    (b) cubic    (c) reciprocal    (d) quadratic
- 15) Let  $f(x) = \sqrt{1+x^2}$  then  
 (a)  $f(xy) = f(x).f(y)$     (b)  $f(xy) \geq f(x).f(y)$     (c)  $f(xy) \leq f(x).f(y)$     (d) None of these

16) Find  $A \times B$ ,  $A \times A$  and  $B \times A$

$$A = \{2, -2, 3\} \text{ and } B = \{1, -4\}$$

17) Let  $A = \{1, 2, 3\}$  and  $B = \{x \mid x \text{ is a prime number less than } 10\}$ . Find  $A \times B$  and  $B \times A$ .

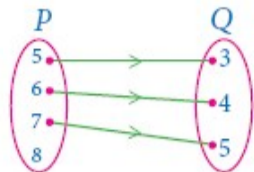
18) If  $B \times A = \{(-2, 3), (-2, 4), (0, 3), (0, 4), (3, 3), (3, 4)\}$  find  $A$  and  $B$ .

19) The arrow 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  $R$ .



20) Let  $A = \{1, 2, 3, 4, \dots, 45\}$  and  $R$  be the relation defined as "is square of a number" on  $A$ . Write  $R$  as a subset of  $A \times A$ . Also, find the domain and range of  $R$ .

21) Let  $f(x) = 2x + 5$ . If  $x \neq 0$  then find  $\frac{f(x+2) - f(2)}{x}$ .

22) A function  $f$  is defined by  $f(x) = 3 - 2x$ . Find  $x$  such that  $f(x^2) = (f(x))^2$ .

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

24) Represent the function  $f(x) = \sqrt{2x^2 - 5x + 3}$  as a composition of two functions.

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

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

27) If  $f(x) = 2x - 1$ ,  $g(x) = \frac{x+1}{2}$ , show that  $f \circ g = g \circ f = x$ .

28) Using the functions  $f$  and  $g$  given below, find  $f \circ g$  and  $g \circ f$ . Check whether  $f \circ g = g \circ f$

$$f(x) = \frac{2}{x}, g(x) = 2x^2 - 1$$

29) If  $f(x) = x^m$  and  $g(x) = x^n$  does  $f \circ g = g \circ f$ ?

30) If  $A = \{1, 3, 5\}$  and  $B = \{2, 3\}$  then show that  $n(A \times B) = n(A) \times n(B)$ .

III. ANSWER ALL QUESTIONS

31) Let  $A = \{x \in \mathbb{N} \mid 1 < x < 4\}$ ,  $B = \{x \in \mathbb{W} \mid 0 \leq x < 2\}$  and  $C = \{x \in \mathbb{N} \mid x < 3\}$  Then verify that

(i)  $A \times (B \cup C) = (A \times B) \cup (A \times C)$

(ii)  $A \times (B \cap C) = (A \times B) \cap (A \times C)$

32) Let  $A = \{x \in \mathbb{W} \mid x < 2\}$ ,  $B = \{x \in \mathbb{N} \mid 1 < x \leq 4\}$  and  $C = \{3, 5\}$ . Verify that

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

33) Let  $A =$  The set of all natural numbers less than 8,  $B =$  The set of all prime numbers less than 8,  $C =$  The set of even prime number.

Verify that

$$(A \cap B) \times C = (A \times C) \cap (B \times C)$$

34) A function  $f$  is defined by  $f(x) = 2x - 3$

i. find  $\frac{f(0) + f(1)}{2}$

ii. find  $x$  such that  $f(x) = 0$

iii. find  $x$  such that  $f(x) = x$

iv. find  $x$  such that  $f(x) = f(1 - x)$

35) 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  $f(x) = 3x - 1$ . Represent this function

(i) by arrow diagram

(ii) in a table form

(iii) as a set of ordered pairs

(iv) in a graphical form

36) Forensic scientists can determine the height (in cms) of a person based on the length of their thigh bone. They usually do so using the function  $h(b) = 2.47b + 54.10$  where  $b$  is the length of the thigh bone.

(i) Check if the function  $h$  is one - one or not

(ii) Also find the height of a person if the length of his thigh bone is 50 cm.

(iii) Find the length of the thigh bone if the height of a person is 147.96 cm.

$$f(x) = \begin{cases} 2x + 7, & x < -2 \\ x^2 - 2, & -2 \leq x < 3 \\ 3x - 2, & x \geq 3 \end{cases}$$

(i)  $f(4)$

(ii)  $f(-2)$

(iii)  $f(4) + 2f(1)$

(iv)  $\frac{f(1) - 3f(4)}{f(-3)}$

38) Let  $f: A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1$ , where  $A = \{2, 4, 6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$ , Represent  $f$  by

(i) set of ordered pairs

(ii) a table

(iii) an arrow diagram

(iv) a graph

39) If the function  $f$  is defined by

$$f(x) = \begin{cases} x + 2 & \text{if } x > 1 \\ 2 & \text{if } -1 \leq x \leq 1 \\ x - 1 & \text{if } -3 < x < -1 \end{cases}$$

find the values of

i)  $f(3)$

ii)  $f(0)$

iii)  $f(-1.5)$

iv)  $f(2) + f(-2)$

40) A function  $f: [-5, 9] \rightarrow \mathbb{R}$  is defined as follows:

$$f(x) = \begin{cases} 6x + 1 & \text{if } -5 \leq x < 2 \\ 5x^2 - 1 & \text{if } 2 \leq x < 6 \\ 3x - 4 & \text{if } 6 \leq x \leq 9 \end{cases}$$

Find

i)  $f(-3) + f(2)$

ii)  $f(7) - f(1)$

iii)  $2f(4) + f(8)$

iv)  $\frac{2f(-2) - f(6)}{f(4) + f(-2)}$

41) 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)  $t(-10)$

(iv) the value of C when  $t(C) = 212$

(v) the temperature when the Celsius value is equal to the Fahrenheit value.

42) Consider the functions  $f(x)$ ,  $g(x)$ ,  $h(x)$  as given below. Show that  $(f \circ g) \circ h = f \circ (g \circ h)$  in each case.

(i)  $f(x) = x - 1$ ,  $g(x) = 3x + 1$  and  $h(x) = x^2$

(ii)  $f(x) = x^2$ ,  $g(x) = 2x$  and  $h(x) = x + 4$

(iii)  $f(x) = x - 4$ ,  $g(x) = x^2$  and  $h(x) = 3x - 5$

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

44) Let  $A =$  The set of all natural numbers less than 8,  $B =$  The set of all prime numbers less than 8,  $C =$  The set of even prime number.

Verify that

$A \times (B - C) = (A \times B) - (A \times C)$

45) Let  $A = \{x \in \mathbb{W} \mid x < 2\}$ ,  $B = \{x \in \mathbb{N} \mid 1 < x \leq 4\}$  and  $C = (3, 5)$ . Verify that

$A \times (B \cap C) = (A \times B) \cap (A \times C)$

46) Let  $A = \{x \in \mathbb{W} \mid x < 2\}$ ,  $B = \{x \in \mathbb{N} \mid 1 < x \leq 4\}$  and  $C = (3, 5)$ . Verify that

$(A \cup B) \times C = (A \times C) \cup (B \times C)$

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