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Register No. _____

First Mid-Term Test - 2023
MATHEMATICS

Time : 1.30 Hrs.

Marks : 50

PART - I

Choose the correct answer   **10 x 1 = 10**

1. Let A and B be subsets of the universal set N, the set of natural numbers. Then A'U[(A ∩ B)UB'] is
   a) A   b) A'   c) B   d) N

2. If A = {(x, y) : y = e^x, x ∈ R}, B = { (x, y) : y = e^{-x}, x ∈ R} then n(A ∩ B) is
   a) infinity   b) 0   c) 1   d) 2

3. If n(A) = 2 and n(BUC) = 3, then n [(A x B) U (A x C)] is
   a) 2^3 b) 3^2 c) 6   d) 5

4. The range of the function $\dfrac{1}{1-2\sin x}$ is

   a) $(-\infty, -1) \cup \left(\dfrac{1}{3}, \infty\right)$ b) $\left(-1, \dfrac{1}{3}\right)$ c) $\left[-1, \dfrac{1}{3}\right]$ d) $(-\infty, -1] \cup \left[\dfrac{1}{3}, \infty\right)$

5. The range of the function f(x) = | |x| – x|, x ∈ R is
   a) [0, 1]   b) [0, ∞)   c) [0, 1)   d) (0, 1)

6. The value of $\log_{\sqrt{2}} 512$ is
   a) 16   b) 18   c) 9   d) 12

7. The value of $\log_3 11.\log_{11} 13.\log_{13} 15.\log_{15} 27.\log_{27} 81$ is
   a) 1   b) 2   c) 3   d) 4

8. The solution set of the following inequality |x – 1| ≥ |x – 3| is
   a) [0, 2]   b) [2, ∞)   c) (0, 2)   d) (−∞, 2)

9. If 3 is the logarithm of 343, then the base is
   a) 5   b) 7   c) 6   d) 9

10. The number of solutions of $x^2 + |x – 1| = 1$ is
    a) 1   b) 0   c) 2   d) 3

PART - II

II. Answer the four questions. 16th question compulsory.   **4 x 2 = 8**

11. If (A) denotes the power set of A1 then find n(p(p(p(φ))))

12. Find the number of subsets of A if A = { x : x = 4n + 1, 2 ≤ n ≤ 5, n ∈ N}

13. Solve for x : |3 – x| < 7

14. If the logarithm of 324 to base a is 4, then find a.

15. Find the complete set of values of a for which the quadratic $x^2 – ax + a + 2 = 0$ has equal roots.

16. If n(A ∩ B) = 3 and n(AUB) = 10, then find n(P (A Δ B))

PART - III

III. Answer the four questions. 22nd question is compulsory.   **4 x 2 = 8**

17. By taking suitbale set A, B, C verify the following result
    (A x B) ∩ (B x A) = (A ∩ B) x (B ∩ A)

18 Let A = {a, b, c} R = { (a, a) (b, b) (a, c) }   Write down the minimum number of ordered pairs to be included to R to make it   i) reflexive   ii) symmetric   iii) transitive   iv) equivalence

19 Let f and g be the two functions from R to R defined by f(x) = 3x – 4 and g(x) = x2 + 3 find gof and fog.

20 Solve $\dfrac{1}{5}$ |10x – 2| < 1

21 Find the real roots of x^4 = 16.

22 Prove $\log\dfrac{a^2}{bc} + \log\dfrac{b^2}{ca} + \log\dfrac{c^2}{ab} = 0$

PART - IV

IV. Answer the following questions.   4 x 5 = 20

23 If A and B are two sets so that n(B–A) = 2n(A – B) = 4n (A ∩ B) and if n(AUB) = 14, then find n(P(A)).

(OR)

b) In the set z of integers, define mRn if m – n is divisible by 7. Prove that R is an equivalence relation.

24 Let f, g   R → R be defined as f(x) = 2x – |x|, and g(x) = 2x + |x|, find fog.

(OR)

b) Write the values of f at –4, 1, –2, 7, 0 if f(x) = $\begin{cases} -x + 4 & \text{if } -x < x \le -3 \\ x + 4 & \text{if } -3 < x < -2 \\ x^2 - x & \text{if } -2 \le x < 1 \\ x - x^2 & \text{if } 1 \le x < 7 \\ 0 & \text{Otherwise} \end{cases}$

25 If f : R → R defined by f(x) = 3x – 5, prove that f is a bijection and find its inverse.

(OR)

b) Find all values of x for which $\dfrac{x^3(x-1)}{(x-2)} > 0$

26 a) Resolve into partial fractions $\dfrac{2x}{(x^2+1)(x-1)}$

(OR)

b) If x = $\sqrt{2} + \sqrt{3}$ find $\dfrac{x^2+1}{x^2-2}$

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