FIRST MID TERM EXAMINATION - 2023
MATHEMATICS

Class : 11

Time : $1\frac{1}{2}$ Hrs

Register No

MAX. MARKS : 50

PART – I

Answer all the questions .

$10 \times 1 = 10$

1. If $A = \{(x, y) : y = e^x, x \in R\}$ and $B = \{(x, y) : y = e^{-x}, x \in R\}$ then $n(A \cap B)$ is
   1) Infinity　　2) 0　　3) 1　　4) 2

2. The number of relations on a set containing 2 elements is
   1) 16　　2) 64　　3) 8　　4) 256

3. Let $f: R \to R$ be defined by $f(x) = 1 + |x|$. Then the range of f is
   1) R　　2) $[1, \infty)$　　3) $(-1, \infty)$　　4) $(-\infty, 1]$

4. The solution of $5x - 1 < 24$ and $5x + 1 > -24$ is
   1) $(4, 5)$　　2) $(-5, -4)$　　3) $(-5, 5)$　　4) $(-5, 4)$

5. Find a so that the sum and product of the roots of the equation $2x^2 + (a - 3)x + 3a - 5 = 0$ are equal is
   1) 1　　2) 2　　3) 0　　4) 0

6. If $\dfrac{kx}{(x + 2)(x - 1)} = \dfrac{2}{x + 2} + \dfrac{1}{x - 1}$, then the value of k is
   1) 1　　2) 2　　3) 3　　4) 4

7. The number of roots of $(x + 3)^4 + (x + 5)^4 = 16$ is
   1) 4　　2) 2　　3) 3　　4) 0

8. Which of the following is not true?
   1) $\sin \theta = -\dfrac{3}{4}$　　2) $\cos \theta = 1$　　3) $\tan \theta = 25$　　4) $\sec \theta = \dfrac{1}{4}$

9. A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?
   1) 10π seconds　　2) 20π seconds　　3) 5π seconds　　4) 15π seconds

10. $\dfrac{\sin(A-B)}{\cos A \cos B} + \dfrac{\sin(B-C)}{\cos B \cos C} + \dfrac{\sin(C-A)}{\cos C \cos A}$ is
    1) $\sin A + \sin B + \sin C$　　2) 1　　3) 0　　4) $\cos A + \cos B + \cos C$

PART – II

Answer any 4 questions. Question No.16 is compulsory.

$4 \times 2 = 8$

11. If $n(P(A)) = 1024$, $n(A \cup B) = 15$ and $n(P(B)) = 32$, then find $n(A \cap B)$.

12. Let $A = \{a, b, c\}$. What is the equivalence relation of smallest cardinality on A? What is the equivalence relation of largest cardinality on A?

13. To secure A grade one must obtain an average of 90 marks or more in 5 subjects each of maximum 100 marks. If one scored 84, 87, 95, 91 in first four subjects, what is the minimum mark one scored in the fifth subject to get A grade in the course?

14. If $\dfrac{\log x}{y - z} = \dfrac{\log y}{z - x} = \dfrac{\log z}{x - y}$, then prove that $xyz = 1$

15. Find the length of an arc of a circle of radius 5 cm subtending a central angle measuring $15°$.

16. Find the value of: $\sin 690°$

15

PART – III

Answer any 4 questions. Question No.22 is compulsory.   4 X 3 = 12

17. Find the range of the function $f(x) = \dfrac{1}{1 - 3\cos x}$

18. From the curve $y = x^3$, draw
    (i) $y = -x^3$ (ii) $y = x^3 + 1$ (iii) $y = (x + 1)^3$

19. Simplify : $\dfrac{1}{3 - \sqrt{8}} - \dfrac{1}{\sqrt{8} - \sqrt{7}} + \dfrac{1}{\sqrt{7} - \sqrt{6}} - \dfrac{1}{\sqrt{6} - \sqrt{5}} + \dfrac{1}{\sqrt{5} - 2}$

20. If $A + B = 45°$, show that $(1 + \tan A)(1 + \tan B) = 2$.

21. Prove that $(\sec A - \csc A)(1 + \tan A + \cot A) = \tan A \sec A - \cot A \csc A$

22. Find all values of x that satisfies the inequality $\dfrac{2x+3}{(x+2)(x+4)} < 0$

PART – IV

Answer all the questions.   4 X 5 = 20

23. **(a)** Two sets have m and k elements. If the total number of subsets of the first set is 112 more than that of the second set, find the values of m and k.

    (OR)

    (b) Write the values of f at $-3, 5, 2 , -1, 0$.

    $$f(x) = \begin{cases} x^2 + x - 5 & if \quad x \in (-\infty, 0) \\ x^2 + 3x - 2 & if \quad x \in (3, \infty) \\ x^2 & if \quad x \in (0, 2) \\ x^2 - 3 & otherwise \end{cases}$$

24. **(a)** In the set Z of integers, define $m R n$ if $m - n$ is a multiple of 12. Prove that R is an equivalence relation.

    (OR)

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

25. **(a)** Resolve into partial fractions: $\dfrac{2x}{(x^2 + 1)(x - 1)}$.

    (OR)

    (b) $\dfrac{\cot(180° + \theta)\sin(90° - \theta)\cos(-\theta)}{\sin(270° + \theta)\tan(-\theta)\csc(360° + \theta)} = \cos^2\theta\cot\theta$.

26. **(a)** If one root of $k(x - 1)^2 = 5x - 7$ is double the other root , show that $k = 2$ or -25.

    (OR)

    (b) If $A + B + C = 180°$, prove that $\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C$