RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah - 711202

ADMISSION TEST - 2022

MATHEMATICS(Honours)

Date : 30/06/2022 **Full Marks : 50** Time : 3:00 pm - 4:00 pm

Instructions for the candidates

- Answer all questions.
- Each question has 4 options out of which only one is correct.
- Tick (✓) the correct option on OMR SHEET.
- The tick (✓) must be very clear − if it is smudgy or not clear, no marks will be awarded.
- Each correct answer carries **2 marks** and for each incorrect answer **1 mark** will be deducted.
- Unanswered questions will not be awarded.
- Multiple answers will be considered as wrong answer.

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1. Consider $y' = c|x|$ over the interval $[-1, 1]$, where c is some real constant. Which of the following statement is true for this ODE?

   (a) Solutions exist for any $c \in \mathbb{R}$.
   (b) Solutions exist only when $c = 0$.
   (c) No solution exists for any $c \in \mathbb{R}$.
   (d) Solutions exist only when $c \geq 0$.

2. Which of the following is true for 2×2 matrices A and B?

   (a) $(A + B)^2 = A^2 + 2AB + B^2$.
   (b) If $A^2B = ABA$, then $AB = BA$.
   (c) If $A^t = B$, then $AB = BA$.
   (d) If $A^t = B$, then AB is a symmetric matrix.

3. Let $I = \int_{-1}^{1} |x \sin \pi x| dx$, then I is equal to

   (a) 0; **(b)** $\frac{1}{\pi}$; **(c)** $\frac{2}{\pi}$; **(d)** $\frac{4}{\pi}$.

4. Let $x, y \in \mathbb{R}$ and $A = \begin{bmatrix} x & y \\ xy & x^2 + y^2 \end{bmatrix}$, then $\lim_{x \to e^2} \det(A)$ is

   (a) e^2; **(b)** e^6; **(c)** e^9; **(d)** None of (a), (b) and (c).

5. If $5(\tan^2 \theta - \cos^2 \theta) = 2 \cos 2\theta + 9$, then $\cos 4\theta =$

   (a) $\frac{1}{3}$ **(b)** $\frac{2}{9}$ **(c)** $-\frac{3}{5}$ **(d)** $-\frac{7}{9}$.

6. If $\cos(\alpha + \beta) = \frac{3}{5}$ and $\sin(\alpha - \beta) = \frac{5}{13}$, where $0 < \alpha, \beta < \frac{\pi}{4}$, then $\tan(2\alpha) =$

   (a) $\frac{21}{16}$ **(b)** $\frac{63}{52}$ **(c)** $\frac{33}{52}$ **(d)** $\frac{63}{16}$.

7. The slope of the normal to $y^2 = 3x$ at $\left(\frac{3}{16}, \frac{3}{4}\right)$ is

   (a) -1 **(b)** -0.5 **(c)** 2 **(d)** 1.

8. For the function $f(x) = x^3$, which of the following statement is true?

   (a) f is strictly increasing at 0.
   (b) f is increasing at 0 but not strictly increasing at 0.
   (c) f is neither increasing nor decreasing at 0 as $f'(0) = 0$.
   (d) None of the statements (a), (b) and (c) is true.

9. The maximum value of $x^{\frac{1}{x}}$ $(x > 0)$ is

   (a) $e^{\frac{1}{e}}$ **(b)** e **(c)** $\sqrt{e}$ **(d)** None of (a), (b) and (c);

10. If the area of the triangle on the complex plane formed by the points z, $z + iz$ and iz is 50, then $|z|$ is

    (a) $5\sqrt{2}$ **(b)** $10\sqrt{2}$ **(c)** 15 **(d)** None of (a), (b) and (c).

11. The equation $\sqrt{x+1} - \sqrt{x-1} = \sqrt{4x-1}$ has

    (a) no solution
    (b) one solution
    (c) two solutions
    (d) more than two solutions.

12. An A. P. whose first term is unity and in which the sum of the first half of any even number of terms to that of the second half of the same number of terms is in constant ratio, the common difference h is given by

    (a) 1 **(b)** 2 **(c)** 3 **(d)** None of (a), (b) and (c).

13. The number of terms which are free from radical signs in the expression of $\left(y^{\frac{1}{5}} + x^{\frac{1}{10}}\right)^{55}$ is

    (a) 4 **(b)** 5 **(c)** 6 **(d)** None of (a), (b) and (c).

14. If $0 < r < s \leq 6$ and ${}^6P_r = {}^6P_s$, then the value of $r + s$ is

    (a) 1 **(b)** 2 **(c)** 11 **(d)** 10 .

15. A family consists of a grandfather, 6 sons and daughters and 4 grand children. They are to be seated in a row for dinner. The grand children wish to occupy the two seats at each end and grand father refuses to have a grand child on either side of him. in how many ways can the seating arrangement be made for the dinner?

    (a) 86400 **(b)** 120960 **(c)** 14400 **(d)** 103680.

16. If 3 distinct numbers are chosen randomly from $\{1, 2, \ldots, 100\}$, then the probability that all are divisible by both 2 and 3 is

    (a) $\frac{4}{25}$ **(b)** $\frac{4}{35}$ **(c)** $\frac{4}{33}$ **(d)** $\frac{4}{1155}$.

17. In a test, an examinee has to give an answer. Now the examinee either guesses or copies or knows the answer to a multiple choice question with four choices. The probability that he makes a guess is $\frac{1}{3}$ and the probability that he copies the answer is $\frac{1}{6}$. The probability that his answer is correct given that he copied it is $\frac{1}{8}$. Assume that if the examinee knew the answer, then it is correctly answered. Find the probability that he knew the answer to the question given that he correctly answered it.

    (a) $\frac{16}{29}$ **(b)** $\frac{16}{21}$ **(c)** $\frac{24}{29}$ **(d)** $\frac{1}{30}$.

18. How many points are there within the triangle with vertices $(0, 0)$, $(10, 0)$ and $(0, 10)$ having integral coordinates?

    (a) 32 **(b)** 35 **(c)** 30 **(d)** None of (a), (b) and (c).

19. If (3, 2), (6, 3) , (x, y) , (6, 5) are the vertices of a parallelogram taken in order then

(a) $(x, y) = (6, 9)$
(b) $(x, y) = (9, 6)$
(c) $(x, y) = (8, 8)$
(d) None of (a), (b) and (c).

20. The acute angle between the lines whose direction ratios are 2, 1, -2 and 1, 1, 0 is

(a) 45° **(b)** 60° **(c)** 75° **(d)** None of (a), (b) and (c).

21. The foot of the perpendicular from the origin to a plane is $(13, -4, -3)$. Then the equation of the plane is

(a) $13x - 4y - 3z - 202 = 0$
(b) $13x - 3y - 4z - 192 = 0$
(c) $13x - 4y - 3z - 194 = 0$
(d) None of (a), (b) and (c).

22. Let $\mathbb{N} = \{1, 2, 3, 4, \ldots\}$ and $\mathbb{N}^2 = \{1, 4, 9, 16, \ldots\}$. The number of bijective maps from $\mathbb{N}$ to $\mathbb{N}^2$ is

(a) 0 **(b)** 1 **(c)** finite but more than 1 **(d)** infinite .

23. The number of symmetric relations on a set containing two elements is

(a) 1 **(b)** 4 **(c)** 8 **(d)** None of (a), (b) and (c).

24. Suppose $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = |2x - 1| \ \forall \ x \in \mathbb{R}$. Then f is not differentiable at

(a) 0 **(b)** 1 **(c)** 2 **(d)** $\frac{1}{2}$.

25. Suppose $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = |\sin x| \ \forall \ x \in \mathbb{R}$. Then f is

(a) not continuous
(b) continuous but not differentiable only at '0'
(c) continuous but not differentiable at infinite number of points
(d) continuous and differentiable.

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