RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under the University of Calcutta)
Belur Math, Howrah - 711202

ADMISSION TEST - 2019

B.Sc.(Honours) in Mathematics

Date : 20/06/2019 **Full Marks : 50** Time : 11:00 am - 12:00 noon

Instruction to the candidates

- Answer all the questions.
- Each question has 4 options out of which only one is correct.
- **Tick (✓)** the correct option on the **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.
- Multiple answers will be considered as wrong answers.

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1. If $a_1, a_2, ..., a_n$ are in Arithmetic Progression with common difference d, then the average of first two and last two terms is

   (a) $\frac{a_1+(n-1)d}{2}$ (b) $a_1 + \frac{n-1}{2}d$ (c) $\frac{a_1+(n-1)d}{4}$ (d) $a_1 + \frac{2n-3}{4}d$.

2. The coefficients of x^5 and x^6 are equal in the expansion of $(3 + x/2)^n$. Then, which of the following is the value of n?

   (a) 9 (b) 17 (c) 41 (d) 14

3. If $f(x) = c|x-1|^{3/2}, x \in \mathbb{R}$ and c is a constant, then the derivative of f at $x = 1$

   (a) exists and is equal to 0
   (b) doesnot exist
   (c) exists only if c = 0
   (d) exists, but $f'(1)$ may not be 0

4. The indefinite integral of

$$\sqrt{x} - \frac{1}{\sqrt{x}} + \sqrt[3]{x}$$

   with respect to x is (Here c is an arbitrary constant.)

   (a) $\frac{2}{3}x^{3/2} - 2x^{1/2} + \frac{3}{4}x^{4/3} + c$
   (b) $x^{3/2} - x^{1/2} + x^{4/3} + c$
   (c) $\frac{2}{3}x^{3/2} - 2x^{-1/2} + \frac{4}{3}x^{4/3} + c$
   (d) $\frac{3}{2}x^{3/2} + 2x^{1/2} + \frac{4}{3}x^{4/3} + c$

5. If $\int_{\pi/2}^{\alpha} \sin x dx = -\frac{1}{\sqrt{2}}$, then the least positive value of α is

   (a) $\frac{\pi}{4}$ (b) $\frac{3\pi}{4}$ (c) $\frac{5\pi}{4}$ (d) $\frac{7\pi}{4}$.

6. The number of ways in which we can choose 5 letters from the word INTERNATIONAL is

   (a) 239 (b) 235 (c) 242 (d) 206

7. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$, then $\sum_{r=0}^{n} \frac{r}{{}^nC_r}$ equals

   (a) $\frac{n}{2}a_n$ (b) $\frac{n}{4}a_n$ (c) na_n (d) $(n-1)a_n$

8. The number of five-digit telephone numbers having at least one of their digits repeated is

   (a) 90000 (b) 100000 (c) 30240 (d) 69760

9. Two tangents, perpendicular to each other, to the parabola $y^2 = 4ax$ intersect on the line

   (a) $x = a$ (b) $x + a = 0$ (c) $x + 2a = 0$ (d) $x - 2a = 0$

10. The equation of the director circle of the hyperbola $9x^2 - 16y^2 = 144$ is

    (a) $x^2 + y^2 = 7$ (b) $x^2 + y^2 = 9$ (c) $x^2 + y^2 = 16$ (d) $x^2 + y^2 = 25$

11. A circle touches x-axis at (3,0) and has an intercept 8 units on the y-axis. The equation of the circle is

    (a) $(x-3)^2 + (y-5)^2 = 25$; (b) $(x-3)^2 + (y+5)^2 = 9$;
    (c) $(x-5)^2 + (y-3)^2 = 9$; (d) $(x+5)^2 + (y-3)^2 = 25$.

12. The coordinates of the foci of an ellipse are (-2,0) and (2,0) and the latus rectum is 6 units. Then the equation of the ellipse is

    (a) $\frac{x^2}{12} + \frac{y^2}{4} = 1$, (b) $\frac{x^2}{16} + \frac{y^2}{12} = 1$, (c) $\frac{x^2}{12} + \frac{y^2}{8} = 1$, (d) $\frac{x^2}{4} + y^2 = 1$.

13. Two complex numbers a and b (with non-zero imaginary part) are such that $a + b = 2$ and $a^4 + b^4 = 272$, then the quadratic equation whose roots are a and b can be

    (a) $x^2 - 2x - 16 = 0$, (b) $x^2 - 2x + 8 = 0$, (c) $x^2 - 2x - 8 = 0$, (d) $x^2 - 2x + 16 = 0$.

14. The slope of the tangent to the curve $x = t^2 + 3t - 8,\ y = 2t^2 - 2t - 5$ at the point (2, -1) is

    (a) $\frac{2}{3}$ (b) $\frac{6}{7}$ (c) $\frac{12}{13}$ (d) $\frac{3}{2}$.

15. If $f(x) = \frac{x^2-1}{x^2+1}$ for every real number x, then the minimum value of f

    (a) does not exist because f is unbounded, (b) is not attained even though f is bounded,
    (c) is equal to 1, (d) is equal to -1.

16. A matrix is chosen at random from the set of all matrices of order 2 with elements 0 or 1 only. The probability that the determinant of that chosen matrix is nonzero, is

(a) $\frac{3}{16}$ (b) $\frac{3}{8}$ (c) $\frac{13}{256}$ (d) $\frac{5}{16}$

17. Let $A = \{1,\ 2,\ 3,\ 4\}$ and $B = \{a,\ b\}$. A function f: $A \rightarrow\ B$ is selected randomly. Probability that function is an onto function is:

(a) $\frac{1}{8}$ (b) $\frac{7}{8}$ (c) $\frac{1}{16}$ (d) $\frac{3}{8}$

18. A sample consists of six points $S = \{(i,\ j) \mid i = 1,\ 2;\ j = 1\ ,2,\ 3\}$. Suppose $P((i,j)) = \frac{k}{i+j}$ where k is a positive real number (less than 2). Let $A = \{(i,\ j)|\ i + j = 4\}$ and $B = \{(i,\ j)|\ j = 2\}$, then $P(B|A)$ is equal to

(a) 0.5 (b) 0.25 (c) 0.125 (d) 0.75

19. If $P = \begin{bmatrix} 1 & x & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of A and det(A)=4, then x is

(a) 4 (b) 11 (c) 5 (d) 0

20. If l, m, n are the pth, qth, and rth term of a G.P., all positive, then $\begin{vmatrix} \log l & p & 1 \\ \log m & q & 1 \\ \log n & r & 1 \end{vmatrix}$ is

(a) -1 (b) 2 (c) 1 (d) 0

21. If the system of linear equations

$$\begin{aligned} x + 2ay + az &= 0 \\ x + 3by + bz &= 0 \\ x + 4cy + cz &= 0 \end{aligned}$$

has a non-zero solution, then $a,\ b,\ c$:

(a) are in A.P. (b) are in G. P. (c) are in H. P. (d) satisfy $a+2b+3c = 0$

22. Let $X = \{1, 2, 3, 4, 5\}$. The number of bijective maps $f : X \rightarrow X$ having exactly two fixed points (x is a fixed point of f if $f(x) = x$ for some $x \in X$) is

(a) 20 (b) 60 (c) 90 (d) none of a,b,c.

23. Suppose X is a set such that each one-one map $f : X \to X$ is a bijection. Then

(a) X is a finite set.
(b) X is a finite set but contains at least two distinct points.
(c) X is a finite set but contains at least three distinct points.
(d) X is infinite.

24. Let $X = \{1, 2\}$. The number of binary relations on X which are symmetric is

(a) 4 (b) 6 (c) 8 (d) 12

25. Suppose $X = \{a, b, c\}$. The number of binary relations on X which are not reflexive is

(a) 112 (b) 224 (c) 336 (d) 448