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Belur Math, Howrah - 711202

M. Sc ADMISSION TEST - 2024

MATHEMATICS

Date : 23/07/2024

Full Marks : 40

Time : 12 noon – 1:00 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 Answer 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.
- Calculator is **not** allowed.

1. The area (in square unit) of the triangle formed by the pair of straight lines  $8x^2 + 10xy + 3y^2 + 26x + 16y + 21 = 0$  and  $x$  axis is

- (a) 1                                      (b) 0.5                                      (c) 0.25                                      (d) 0.125 .

Ans. d

2. The equation  $r \sin \theta = 2$  in spherical polar coordinates represents

- (a) a circle,  
(b) a right circular cylinder,  
(c) a plane,  
(d) a straight line .

Ans. b

3. The orthogonal trajectories of the family of circles  $x^2 + y^2 + 2fy + 1 = 0$ , where  $f$  is a parameter; is

- (a)  $x^2 + y^2 = cx + 1$ , (where  $c$  being a parameter)  
(b)  $x^2 + y^2 = cx$ , (where  $c$  being a parameter)  
(c)  $x^2 + y^2 = c$ , (where  $c$  being a parameter)  
(d)  $c(x^2 + y^2) = x + 1$ , (where  $c$  being a parameter).

Ans. a

4. What is the coordinate of  $(1, 2, 3, 4)$  in  $\mathbb{R}^4$  with respect to the ordered basis  $\{(1, 0, 0, 0), (0, 2, 0, 0), (0, 0, 3, 0), (0, 0, 0, 4)\}$ ?

- (a)  $(1, 0, 0, 0)$ ,                                      (b)  $(0, 1, 0, 0)$ ,                                      (c)  $(0, 0, 0, 1)$ ,                                      (d)  $(1, 1, 1, 1)$

Ans. d

5. Nullity of the linear operator represented by the matrix  $\begin{bmatrix} -1 & -2 & -1 \\ 0 & 6 & 1 \\ -1 & 13 & 0 \end{bmatrix}$  is

- (a) 3                                      (b) 2                                      (c) 1                                      (d) 0 .

Ans. d

6. How many linear transformations are there from  $\mathbb{R}^3$  to  $\mathbb{R}^2$  which sends  $(1, -1, 1)$  to  $(1, 0)$ ,  $(1, 1, 1)$  to  $(0, 1)$  and  $(1, 0, 0)$  to  $(1, 1)$ ?

- (a) infinitely many                                      (b) none                                      (c) 2                                      (d) 1 .

Ans. d



- (c) (B) is true and (A) is false.
- (d) Both of (A) and (B) are false.

Ans. d

15. Which of the following series is conditionally convergent ?

- (a)  $\sum_{n=1}^{\infty} (-1)^n$
- (b)  $\sum_{n=1}^{\infty} \frac{1}{n}$
- (c)  $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$
- (d)  $\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2}$

Ans. c

16. Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  satisfies  $|f(x) - f(y) - x + y| \leq \sin(|x - y|^2)$  for all  $x, y \in \mathbb{R}$ . Then  $f$  is

- (a) differentiable on  $\mathbb{R}$  with bounded derivative.
- (b) Lipschitz, but not necessarily differentiable with bounded derivative.
- (c) uniformly continuous, but not necessarily Lipschitz.
- (d) continuous, but not necessarily uniformly continuous.

Ans. a

17. The function  $d : \mathbb{R}^2 \times \mathbb{R}^2 \rightarrow [0, \infty)$  is not a metric on  $\mathbb{R}^2$ , when

- (a)  $d((x_1, y_1), (x_2, y_2)) = \max\{|x_1 - x_2|, |y_1 - y_2|\}$ .
- (b)  $d((x_1, y_1), (x_2, y_2)) = \min\{|x_1 - x_2|, |y_1 - y_2|\}$ .
- (c)  $d((x_1, y_1), (x_2, y_2)) = (|x_1 - x_2|^2 + |y_1 - y_2|^2)^{1/2}$ .
- (d)  $d((x_1, y_1), (x_2, y_2)) = |x_1 - x_2| + |y_1 - y_2|$ .

Ans. b

18. Suppose G is an infinite cyclic group, then G has

- (a) only one generator
- (b) exactly two generators
- (c) more than two but finitely many generators
- (d) infinitely many generators.

Ans. b

19. Let  $S_3$  be the symmetric group of all permutations on a set having 3 elements, then the center of  $S_3$  has

- (a) 1 element
- (b) 2 elements
- (c) 3 elements
- (d) 6 elements

Ans. a

20. In the ring of all integers, which of the following options is correct

- (a) there is no maximal ideal
- (b) there is only one maximal ideal
- (c) there are exactly two maximal ideals
- (d) there are infinitely many maximal ideal.

Ans. d