## RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah - 711202

## $\begin{array}{c} \text{M. Sc ADMISSION TEST - 2024} \\ \text{MATHEMATICS} \end{array}$

Date: 23/07/2024	Full Marks: 40	Time: $12 \text{ noon} - 1:00 \text{ pm}$

## Instructions for the candidates

	instructions to	r the candidates	
• Answer all question	ons.		
• Each question has	4 options out of which only	one is correct.	
• Tick (✓) the corre	ect option on Answer Sheet.		
• The tick (✓) mus	t be very clear — if it is smu	dgy or not clear, no mark	s will be awarded.
• Each correct answ	ver carries 2 marks and for	each incorrect answer 1 n	nark will be deducted.
• Unanswered quest	ions will not be awarded.		
• Multiple answers	will be considered as wrong	answer.	
• Calculator is <b>not</b>	allowed.		
1. The area (in square $16y + 21 = 0$ and		d by the pair of straight li	$nes 8x^2 + 10xy + 3y^2 + 26x +$
(a) 1 Ans. d	<b>(b)</b> 0.5	(c) 0.25	(d) 0.125.
2. The equation $r \sin r$	$\theta = 2$ in spherical polar coo	rdinates represents	
<ul><li>(a) a circle,</li><li>(b) a right circula</li><li>(c) a plane,</li><li>(d) a straight line</li><li>Ans. b</li></ul>			
3. The orthogonal tr	ajectories of the family of cir	$x^2 + y^2 + 2fy + 1 = 0$	0, where $f$ is a parameter; is
(b) $x^2 + y^2 = cx$ , (c) $x^2 + y^2 = c$ , (	+ 1, (where $c$ being a parameter) (where $c$ being a parameter) where $c$ being a parameter) c + 1, (where $c$ being a parameter)		
		th respect to the ordered	basis $\{(1,0,0,0),(0,2,0,0),$
(0,0,3,0), (0,0,0, <b>(a)</b> (1,0,0,0), Ans. d	<b>(b)</b> (0, 1, 0, 0),	(c) $(0,0,0,1)$ ,	<b>(d)</b> (1, 1, 1, 1)
5. Nullity of the line	ar operator represented by t	he matrix $\begin{bmatrix} -1 & -2 & -1 \\ 0 & 6 & 1 \\ 1 & 12 & 0 \end{bmatrix}$	is
(a) 3 Ans. d	<b>(b)</b> 2	(c) 1	(d) 0.
6. How many linear (0, 1) and (1, 0, 0)		om $\mathbb{R}^3$ to $\mathbb{R}^2$ which sends (	(1,-1,1) to $(1,0)$ , $(1,1,1)$ to

(b) none

(a) infinitely many

Ans. d

**(c)** 2

**(d)** 1.

7.	Which of the following statements is true for the degree $M$ of the Lagrange's interpolating polynomic for a data set containing $n$ data points?					
	(a) $M$ and $n$ are always	ys equal.				
	(b) It is possible, in se	ome cases, to have $M <$	n.			
	(d) No equality or ine	equality relation exists b	between $M$ and $n$ .			
	Ans. b					
8.	. Which of the following statements is correct for the Newton Raphson method for solving equat of the form $f(x) = 0$ in an interval $[a, b]$ ?					
	(a) It is a fixed point	(a) It is a fixed point method.				
	(b) Convergence is gu	twice differentiable.				
	(c) Convergence is guaranteed whenever there is a unique root in the interval $[a, b]$ . (d) Convergence is guaranteed unconditionally.					
	Ans. a					
9.	A particle $P$ possesses	s two constant velocitie	s $u$ and $v$ , such that $u$	is always parallel to a fixed		
	A particle $P$ possesses two constant velocities $u$ and $v$ , such that $u$ is always parallel to a fixed direction $OX$ and $v$ is always perpendicular to the radius vector $OP$ . The path of the particle is a					
	conic of eccentricity (a) $\frac{u}{v}$	(b) $\frac{v}{u}$	(c) $\frac{u^2}{v}$	(d) $\frac{v^2}{2}$		
	Ans. a	$(\mathcal{S})_{u}$		$(\mathbf{u})_{u}$		
10.	The envelope of straight is	at lines $\frac{x}{a} + \frac{y}{b} = 1$ where	e the parameters are con	nnected by the relation $ab = c$		
	(a) $xy = \frac{4}{c^2}$ Ans. d	<b>(b)</b> $x^2 = 4cy$	(c) $\sqrt{x} + \sqrt{y} = \sqrt{x}$	$(\mathbf{d}) \ xy = \frac{c^2}{4}$		
11.	In which of the following	ng sets, is the curve $y =$	$e^x(\cos x + \sin x), \ x \in (0$	$(0,2\pi)$ concave upwards?		
	(a) $(0, \frac{\pi}{2}) \cup (\frac{5\pi}{4}, 2\pi)$ Ans. b	<b>(b)</b> $(0, \frac{\pi}{4}) \cup (\frac{5\pi}{4}, 2\pi)$	(c) $(0, \frac{\pi}{2}) \cup (\frac{3\pi}{4}, 2\pi)$	(d) $(0, \frac{\pi}{4}) \cup (\frac{3\pi}{4}, 2\pi)$		
12.	The value of the integral $\int_C \frac{dz}{z^2}$ , where C is the positively oriented circle $z = 2e^{i\theta}$ $(-\pi < \theta \le \pi)$ about					
	the origin is:					
	(a) 1 Ans. d	<b>(b)</b> 2	(c) -1	<b>(d)</b> 0		
13.		as $f(x,y) = x^2 - y^2$ . Wh	nich of the following stat	tements is not true?		
	(a) $f(x,0)$ has a mini	mum at $(0,0)$ .				
	(b) $f(0,y)$ has a maximum at $(0,0)$ . (c) $f(x,y)$ has a saddle point at $(0,0)$ .					
	(d) Hessian of $f$ is po	sitive definite at $(0,0)$ .				
	Ans. d					
14.	Consider the statement	ts:				
	(A): Every Riemann in	tegrable function define	ed on $[0,1]$ , must have a	primitive on $[0,1]$ .		

(B): Every function having a primitive on [0,1], must be Riemann integrable on [0,1].

(a) Both of (A) and (B) are true.

Which of the following statements is true?

(b) (A) is true and (B) is false.

	<ul><li>(c) (B) is true and (A) is false.</li><li>(d) Both of (A) and (B) are false.</li></ul>
	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 $f: \mathbb{R} \to \mathbb{R}$ satisfies $ f(x) - f(y) - x + y  \le \sin( x - y ^2)$ for all $x, y \in \mathbb{R}$ . Then $f$ is
	<ul> <li>(a) differentiable on R with bounded derivative.</li> <li>(b) Lipschitz, but not necessarily differentiable with bounded derivative.</li> <li>(c) uniformly continuous, but not necessarily Lipscitz.</li> <li>(d) continuous, but not necessarily uniformly continuous.</li> </ul>
	Ans. a
17.	The function $d: \mathbb{R}^2 \times \mathbb{R}^2 \to [0, \infty)$ 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
	<ul> <li>(a) only one generator</li> <li>(b) exactly two generators</li> <li>(c) more than two but finitely many generators</li> <li>(d) infinitely many generators.</li> </ul>
	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
	<ul><li>(a) there is no maximal ideal</li><li>(b) there is only one maximal ideal</li><li>(c) there are exactly two maximal ideals</li></ul>

(d) there are infinitely many maximal ideal.

Ans. d