

Mangalore University

Entrance Examination for Admission to M. Sc. Mathematics Programme 2022-23

Time : **60 minutes**

Max. marks : **50**

Details of the Candidate

Application Number	Name of the Candidate	Signature of the Candidate	Signature of the Invigilator

Note

- Answer all questions. Each question carries **2 marks**.
- Choose/Tick the most appropriate response from the given four alternatives.

-
1. The rank of the 4×6 matrix $\begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$
- (a) 1. (b) 2. (c) 3. (d) 4. ✓
2. The dimension of the vector space of all skew symmetric matrices of order 2×2 with real entries is
- (a) 2. (b) 3. (c) 1. ✓ (d) 4.
3. The number of maps from a set of 4 elements to a set of 3 elements is
- (a) 36. (b) 69. (c) 64. (d) 81. ✓
4. Which of the following is TRUE?
- (a) Every proper subgroup of \mathbb{Z}_n is cyclic. ✓ (c) Every proper subgroup of S_4 is cyclic.
(b) \mathbb{Z}_n is cyclic iff n is prime. (d) Every subgroup of an abelian group is cyclic.
5. The number of generators of the additive group \mathbb{Z}_{36} is
- (a) 6. (b) 12. ✓ (c) 36. (d) 18.
6. Let σ be an element of the permutation group S_3 . Then the maximum possible order of σ is
- (a) 5. (b) 3. ✓ (c) 6. (d) 2.

7. What is the value of $\phi(500)$, where ϕ represents Euler totient function.
- (a) 100. (b) 500. (c) 250. (d) 200. ✓
8. For $0 < a < b$, $\lim_{n \rightarrow \infty} \frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ equals
- (a) a (b) b ✓ (c) 1 (d) 0
9. $\lim_{x \rightarrow \infty} \frac{x}{e^x}$ equals
- (a) 0. ✓ (b) 1. (c) e . (d) ∞ .
10. Let R be a commutative ring with identity, whose only ideals are (0) and R itself. Then R is
- (a) integral domain. (b) field. ✓ (c) division ring. (d) none.
11. The general solution of $y'' + y = 0$ is
- (a) $y = C_1 \sin x + C_2 \cos x$. ✓ (c) $y = e^x(C_1 \sin x + C_2 \cos x)$.
 (b) $y = C_1 x^{-1} \sin x + C_2 x^{-1} \cos x$. (d) $y = x^{-1}(C_1 \sin \log x + C_2 \cos \log x)$.
12. The set of all points (x, y) satisfying $x, y \geq 0$, $y + x \geq 2$, $y + 4x \geq 4$ is
- (a) Bounded. (c) Empty.
 (b) Open. (d) Unbounded. ✓
13. If zero is a root of the characteristic equation of a matrix A , then A is
- (a) singular matrix. ✓ (c) non singular matrix.
 (b) symmetric matrix. (d) identity matrix.
14. Which of the following is an exact differential equation?
- (a) $(y^2 - 4xy - y)dx + (y^2 - 4xy - 2x^2)dy = 0$.
 (b) $(y^2 - 4xy - 2x^2)dx + (x^2 - 4xy - 2y^2)dy = 0$.
 (c) $(x^2 - 2x^2y - 2y^2)dx + (y - 4xy - 2x^2)dy = 0$.
 (d) $(x^2 - 2xy - y^2)dx - (x + y)^2dy = 0$. ✓
15. The function $f(x) = \begin{cases} x \sin \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0. \end{cases}$ Then f is
- (a) continuous and differentiable. (c) discontinuous but differentiable.
 (b) continuous but not differentiable. ✓ (d) none.

16. Total number of edges in the complete graph K_7 is

- (a) 21. ✓ (b) 18. (c) 49. (d) 28.

17. The Simpson's one-third rule for approximating the value of $I = \int_{x_0}^{x_0+nh} f(x)dx$ is given by

- (a) $I \approx \frac{h}{3} [f(x_0) + f(x_n) + 2\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 4\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$.
 (b) $I \approx \frac{h}{3} [f(x_0) + f(x_n) + 4\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 2\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$. ✓
 (c) $I \approx \frac{h}{2} [f(x_0) + f(x_n) + 4\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 2\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$.
 (d) $I \approx \frac{h}{2} [f(x_0) + f(x_n) + 2\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 4\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$.

18. $\lim_{n \rightarrow \infty} (n)^{1/n}$ equals

- (a) 0. (b) 1. ✓ (c) e (d) ∞

19. The unit digit of 4^{2020} is

- (a) 2. (b) 4. (c) 6. ✓ (d) 8.

20. The solution of the initial value problem $4y'' - 8y' + 3y = 0$; $y(0) = 1$, $y'(0) = 3$

- (a) $-\frac{3}{2}e^{\frac{x}{2}} + \frac{5}{2}e^{\frac{3x}{2}}$. ✓ (b) $\frac{3}{2}e^{\frac{x}{2}} - \frac{5}{2}e^{\frac{3x}{2}}$. (c) $-\frac{3}{2}e^{\frac{-x}{2}} + \frac{5}{2}e^{\frac{-3x}{2}}$. (d) $\frac{3}{2}e^{\frac{-x}{2}} - \frac{5}{2}e^{\frac{-3x}{2}}$.

21. The number of 3 digit numbers formed with $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ last digit being odd are

- (a) 400. (b) 450. ✓ (c) 350. (d) 300.

22. In \mathbb{Z}_5 , order of 2 is

- (a) 1. (b) 5. ✓ (c) 2. (d) 4.

23. For the sequence $\{\frac{n}{n+1}\}$, which of the statement is not true.

- (a) The sequence is convergent. (c) The sequence is bounded.
 (b) The sequence is increasing. (d) The sequence is divergent. ✓

24. Let $x_1 = 1$ and $x_{n+1} = \frac{1}{2}x_n^2$. Then $\lim_{n \rightarrow \infty} x_n$ equals

- (a) 0. ✓ (b) 2. (c) 1/2. (d) ∞ .

25. If every edge of the graph G appears exactly once in a path, then it is

- (a) Hamiltonian path (b) Simple path. (c) Eulerian path. ✓ (d) Shortest path.

Application Number:

Name:

Space for Rough Work