

Test Booklet

Series

A

Test Booklet No.

**Test Booklet
MATHEMATICS**

Name of Applicant Answer Sheet No.

Applicant Roll No. : Signature of Applicant :

Date of Examination: Signature of the Invigilator(s)
1.

Time of Examination : 2.

Duration : 1½ Hours]

[Maximum Marks : 70

IMPORTANT INSTRUCTIONS

- (i) The question paper is in the form of Test-Booklet containing **70 (Seventy)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct. Choose the correct option or the most appropriate option.
- (ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **70** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- (iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **70** rows containing four circles each. One row pertains to one question.
- (iv) The candidate should write his/her Application ID/Roll number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and **NOWHERE ELSE**.
- (v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.
- (vi) For every correct answer of the question **One (1) mark will be awarded**.
- (vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.
- (viii) To mark the answer on the Answer-Sheet, candidate should **darken** the appropriate circle in the row of each question with Blue or Black pen.
- (ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the answer will be treated as incorrect.
- (x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.
- (xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.
- (xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*
- (xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

PART-A

Direction (Q. 1-5) : Study the following information carefully and answer the questions given below :

Nine persons - Pranav, Preeti, Manoj, Antu, Bhola, Rekha, Reema, Naina and Shiva lives in nine different flats of a building of three floors from one to three such that ground floor is numbered 1 and top floor is numbered 3. There were three flats on each floor- flat-1, flat-2 and flat-3 from west to east such that flat-1 of third floor is exactly above flat-1 of second floor which is exactly above flat-1 of first floor and other flats are placed in the same way. Pranav lives in an even numbered flat. Reema lives just above Antu in a flat numbered 3. Pranav does not live on the same floor on which Reema lives. Rekha lives just above Naina. Naina does not live on the same floor on which Antu lives. Bhola lives just below Antu. Manoj lives immediate left to Shiva.

- Four of the following five are alike in a certain way and hence form a group. Which of the following is the one that does not belong to the group?
(A) Manoj (B) Rekha
(C) Shiva (D) Reema
- Who among the following lives between Rekha and Antu?
(A) Preeti (B) Shiva
(C) Pranav (D) Either Preeti or Pranav
- How many persons live below Naina?
(A) None (B) One
(C) Two (D) Can't be determined
- Which of the following combinations is definitely correct?
(A) Preeti - Floor 1 - Flat 1 (B) Manoj - Floor 3 - Flat 2
(C) Bhola - Floor 1 - Flat 1 (D) Naina - Floor 1 - Flat 1
- If Bhola is related to Manoj, then Naina is to _____?
(A) Antu (B) Shiva
(C) Reema (D) Rekha

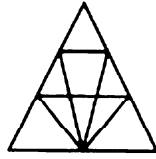
Directions (Q. 6-8) : In each of the following questions four options are given, of which one word is most nearly the same or opposite in meaning to the given word in the question. Find the correct option having either same or opposite meaning.

6. Nondescript
(A) Conducive (B) Discern
(C) Tantamount (D) Defined
7. CORPULENT
(A) Lean (B) Gaunt
(C) Emaciated (D) Obese
8. EMBEZZLE
(A) Misappropriate (B) Balance
(C) Remunerate (D) Clear

Directions (Q. 9) : Each of the following sentences has blank space and four words are given after the sentence. Select whichever word you consider most appropriate for the blank space

9. His _____ directions misled us, we did not know which road to take
(A) complex (B) obscure
(C) mingled (D) vague
10. Find out the correct sentence which is punctuated correctly-
(A) He gathered the leaves and got ready to jump in.
(B) He gathered the leaves, and got ready to jump in.
(C) He gathered the leaves, got ready to jump in.
(D) All are correct
11. A family went for a vacation. Unfortunately, it rained daily for 13 days when they were there. But whenever it rained in the mornings, they had clear afternoons and vice versa. In all, they enjoyed 11 mornings and 12 afternoons. How many days in all did they stay there?
(A) 15 (B) 18
(C) 20 (D) 25

12. Find the number of triangles in the given figure.



- (A) 12 (B) 18
(C) 22 (D) 26

13. In a certain code, cloud is written as GTRKF. How is SIGHT written in that code?

- (A) UGHHT (B) UHJFW
(C) WFJGV (D) WGJHV

14. Find the difference between the simple interest and the compound interest at 5% per annum for 2 years on principal of Rs. 2000.

- (A) 5 (B) 10.5
(C) 4.5 (D) 5.5

15. In the Bombay Stock Exchange there are 45% female employees and thus the number of male employees is exceeded by 72. Hence the total no. of employees in the BSE is

- (A) 540 (B) 720
(C) 800 (D) 550

16. World Athletics Day is celebrated on which day every year?

- (A) May 6 (B) May 7
(C) May 8 (D) May 9

17. Which country is the host of 2025 G7 Summit?

- (A) Italy (B) Germany
(C) Japan (D) Canada

18. What is the theme of World Environment Day 2025?
 (A) Our Land Our Future (B) Only One Earth
 (C) Putting an End to Plastic Pollution (D) Time for Nature
19. What is the name of the initiative launched by India Post to boost access to educational material across the country?
 (A) Gyan Post (B) Sarv Shiksha
 (C) Vidya Vahan (D) PostPathshala
20. Which state has become the first fully literate state in India?
 (A) Mizoram (B) Assam
 (C) Uttarakhand (D) Himachal Pradesh

PART-B

21. Which one of the following function is not differentiable at any point of its domain?
 (A) e^z (B) $\sin z$
 (C) \bar{z} (D) $\frac{z^2}{1-z}$
22. The function $f(z) = |z|^2$ is
 (A) Everywhere analytic (B) Nowhere analytic
 (C) Analytic only at $z = 0$ (D) Analytic at $z = i, -i$
23. Which of the following result is false, where symbols have their usual meaning?
 (A) $E\Delta \equiv \Delta E$ (B) $E \equiv 2 + \Delta$
 (C) $\Delta\nabla \equiv \Delta - \nabla$ (D) $E \equiv 1 + \Delta$
24. Consider the system of equations $\begin{bmatrix} 1 & -a \\ -a & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a \\ b \end{bmatrix}$ where a is a real constant. For what value of a , Gauss-Seidel method converges :
 (A) $|a| < 1$ (B) $|a| > 1$
 (C) $a = 1$ (D) $a = 2$

25. If $\mathcal{L} \left\{ \frac{\sin t}{t} \right\} = \tan^{-1} \frac{1}{p}$ (where \mathcal{L} represents Laplace transform) then $\mathcal{L} \left\{ \frac{\sin at}{t} \right\}$ is :

(A) $\tan^{-1} \frac{a}{p}$

(B) $\tan^{-1} \frac{1}{ap}$

(C) $\frac{1}{a} \tan^{-1} \frac{1}{p}$

(D) $\tan^{-1} ap$

26. Improper integral $\int_{-\infty}^{\infty} x e^{-x^2} dx$ converges to

(A) 1

(B) 2

(C) 0

(D) 3.

27. If $\mathcal{L} \left\{ 2\sqrt{\frac{t}{\pi}} \right\} = p^{-\frac{3}{2}}$ then $\mathcal{L} \left\{ \sqrt{\frac{1}{\pi t}} \right\}$ is

(A) p

(B) \sqrt{p}

(C) p^{-1}

(D) $p^{-\frac{1}{2}}$.

28. Every finite group of order less than six is :

(A) Always cyclic

(B) Always abelian

(C) Always non-abelian

(D) None of these.

29. Which of the following statement is NOT true?

(A) The polynomial ring $\mathbb{Z}[x]$ is a Principal Ideal Domain (PID).

(B) The polynomial ring $\mathbb{Q}[x]$ is a Principal Ideal Domain (PID).

(C) The polynomial ring $\mathbb{Z}[x]$ is a Unique Factorization Domain (UFD).

(D) The polynomial ring $\mathbb{Q}[x]$ is a Unique Factorization Domain (UFD).

30. Consider the ODE $x \frac{dy}{dx} - 3y = x^2 \sqrt{y}$, $y(1) = 1$. Find the value of $y(2)$:
- (A) 14 (B) 16
(C) 0 (D) 8.
31. Let A be a 2×2 real matrix with $\det(A) = 1$ and $\text{trace}(A) = 3$. What is the value of $\text{trace}(A^2)$?
- (A) 9 (B) 7
(C) 2 (D) 10.
32. Let γ be the positively oriented circle in the complex plane given by $\{z \in \mathbb{C} : |z-1|=1\}$. Then $\frac{1}{2\pi i} \int_{\gamma} \frac{dz}{z^3-1}$ equal to
- (A) 2 (B) 3
(C) 1/2 (D) 1/3.
33. Let X be a non-empty set and $P(X)$ be the set of all subsets of X . On $P(X)$, define two operations $*$ and Δ as follows : for $A, B \in P(X)$, $A * B = A \cap B$; $A \Delta B = (A \cup B) \setminus (A \cap B)$. Which of the following statements is true?
- (A) $P(X)$ is a group under $*$ as well as under Δ .
(B) $P(X)$ is a group under $*$ but not under Δ .
(C) $P(X)$ is a group under Δ but not under $*$.
(D) $P(X)$ is neither a group under $*$ nor under Δ .
34. If $f(x) = \begin{cases} x^3 \sin \frac{1}{x}; & x \neq 0 \\ 0; & x = 0 \end{cases}$ be a function, then
- (A) $f(x)$ is not continuous at $x = 0$ (B) $f(x)$ is differentiable at $x = 0$
(C) $f(x)$ is not continuous at $x = 1$ (D) $f(x)$ is not continuous at $x = 2$.

35. Let A and B be $n \times n$ matrices. Suppose the sum of the elements in any row of A is 2 and the sum of the elements in any column of B is 2. Which of the following matrices is necessarily singular?

- (A) $I - \frac{1}{2} AB$ (B) $I + \frac{1}{4} AB$
 (C) $I - \frac{1}{2} BA^T$ (D) None of these.

36. If $u(x, y) = \ln\left(\frac{x^5 + y^5}{(x + y)^5}\right) + \left(\frac{x^5 + y^5}{x + y}\right)$, then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is equal to :

- (A) $4\left(\frac{x^5 + y^5}{x + y}\right)$ (B) $\ln\left(\frac{x^5 + y^5}{(x + y)^5}\right)$
 (C) $\left(\frac{x^5 + y^5}{x + y}\right)$ (D) 0.

37. For the function $u(x, y) = x^3 + y^3 - 3axy$, which of the following statement is true?

- (A) $(0, 0)$ is a point of maxima. (B) $(0, 0)$ is a point of minima.
 (C) (a, a) is a point of maxima if $a > 0$. (D) (a, a) is a point of maxima if $a < 0$.

38. If $f = (x + y + 1)i + j + (-x - y)k$, then the value of $f \cdot \text{curl}(f)$ is :

- (A) f (B) 1
 (C) 2 (D) 0.

39. If V is volume enclosed by any closed surface S , then which of the following is true?

- (A) $\int_S r \cdot \hat{n} dS = 0$ (B) $\int_S r \cdot \hat{n} dS = V$
 (C) $\int_S r \cdot \hat{n} dS = 3V$ (D) $\int_S r \cdot \hat{n} dS = 2V$.

40. The equation of right circular cylinder having axis $x = 2y = -z$ and radius 4 is equal to :
- (A) $5x^2 + 8y^2 + 5z^2 + 4yz + 8zx + 4xy = 144$
 (B) $5x^2 + 8y^2 + 5z^2 + 4yz + 8zx - 4xy = 144$
 (C) $5x^2 + 8y^2 + 5z^2 + 4yz + 4zx + 4xy = 144$
 (D) $5x^2 + 8y^2 + 5z^2 + 8yz + 4zx - 4xy = 144.$
41. Two spheres of radii r_1 and r_2 cut orthogonally, then the radius of their common circle is :
- (A) $\frac{r_1 r_2}{r_1^2 + r_2^2}$ (B) $\frac{2r_1 r_2}{r_1^2 + r_2^2}$
 (C) $\frac{r_1 r_2}{\sqrt{(r_1^2 + r_2^2)}}$ (D) $\frac{2r_1 r_2}{\sqrt{(r_1^2 + r_2^2)}}$
42. The equation of the cone whose vertex is $(0, 0, 0)$ and guiding curve is $x^2 + y^2 = 4, z = 3$ is :
- (A) $x^2 + y^2 - z^2 = 0$ (B) $9x^2 + 9y^2 - 4z^2 = 0$
 (C) $9x^2 + 9y^2 - z^2 = 0$ (D) $x^2 + y^2 - 4z^2 = 0.$
43. If $A = \begin{bmatrix} 2025 & 2022 \\ 2024 & 2023 \end{bmatrix}$, then the value of $|A^{2025} - A^{2024}|$ is :
- (A) 1 (B) 2025
 (C) 2022 (D) 0.
44. The number of elements of order 5 in the symmetric group S_5 is :
- (A) 24 (B) 12
 (C) 25 (D) 5.
45. Let F be field with 5^{12} elements. What is the total number of proper subfields of F ?
- (A) 3 (B) 8
 (C) 6 (D) 5.

46. If $f(x)$ has the Fourier transform $F(p)$, then $f(x) \cos ax$ has the Fourier transform :

- (A) $\frac{1}{2}[F(p-a) + F(p+a)]$ (B) $3[F(p-a) + F(p+a)]$
(C) $2[F(p-a) + F(p+a)]$ (D) $\frac{1}{2}[F(p-a) - F(p+a)]$.

47. In Lagrange interpolation formula, the sum of Lagrangian coefficients is always :

- (A) 0 (B) 1
(C) Equal to number of variables (D) None of these.

48. The Fourier cosine transform of e^{-x} is :

- (A) $\sqrt{\frac{2}{\pi}}\left(\frac{1}{p^2+1}\right)$ (B) $\sqrt{\frac{2}{\pi}}\left(\frac{p}{p^2+1}\right)$
(C) $\sqrt{\frac{2}{\pi}}\left(\frac{1}{1-p^2}\right)$ (D) $\sqrt{\frac{2}{\pi}}\left(\frac{p}{1-p^2}\right)$.

49. In order to find solution of algebraic equations, we use different methods. Which one of the following method does converge necessarily?

- (A) Bisection Method (B) Newton's Method
(C) Secant Method (D) Iterative Method.

50. If $f(x, y) = \begin{cases} \frac{(x-y)^2}{x^2+y^2}; & (x, y) \neq (0, 0) \\ 0 & ; (x, y) = (0, 0) \end{cases}$ then

- (A) $\lim_{x \rightarrow 0, y \rightarrow 0} f(x, y) = 1$ (B) $\lim_{x \rightarrow 0, y \rightarrow 0} f(x, y) = 0$
(C) $\lim_{x \rightarrow 0, y \rightarrow 0} f(x, y)$ does not exist (D) None of these.

51. The region in which partial differential equation $yu_{xx} + 2xy u_{xy} + xu_{yy} = u_x + u_y$ is hyperbolic :
- (A) $xy \geq 0$ (B) $xy > 1$
 (C) $xy \neq 0$ (D) $xy \neq 1$.
52. The solution of the partial differential equation $u_{xx} + 2u_{xy} + u_{yy} = e^{2x+3y}$ is :
- (A) $u = f(y-x) + xf(y-x) + \frac{1}{25}e^{2x+3y}$ (B) $xu = f(y-x) + xf(y-x) + \frac{1}{50}e^{2x+3y}$
 (C) $u = f(y-x) + xf(y-x) + \frac{1}{250}e^{2x+3y}$ (D) $u = f(y-x) + xf(y-x) + \frac{1}{20}e^{2x+3y}$
53. For the function $f(x, y) = \frac{y}{x^2 + y^2}$, the direction derivative making an angle 30° with the positive x -axis at the point $(0, 1)$ is :
- (A) $-\frac{1}{2}$ (B) $\frac{1}{2}$
 (C) $-\frac{1}{4}$ (D) $\frac{1}{4}$.
54. The solution of differential equation $z^2dx + (z^2 - 2yz)dy + (2y^2 - yz - zx)dz = 0$ is equal to :
- (A) $xy + yz + zx = cz^2$ (B) $yz + zx - z^2 = cy^2$
 (C) $yz + zx - x^2 = cy^2$ (D) $yz + zx - y^2 = cz^2$.
55. The general solution of the partial differential equation $z(xp - yq) = y^2 - x^2$ is :
- (A) $F(x - y, x^2 + y^2 + z^2) = 0$ (B) $F(x + y, x^2 - y^2 - z^2) = 0$
 (C) $F(xy, x^2 + y^2 + z^2) = 0$ (D) $F\left(\frac{x}{y}, x^2 + y^2 + z^2\right) = 0$.
56. A particle is moving in a SHM, having amplitude a . At what distance from centre will its velocity be half of the maximum velocity?
- (A) $2a$ (B) $\frac{a}{2}$
 (C) $a\sqrt{3}$ (D) $\frac{a\sqrt{3}}{2}$.

57. The maximum value of the solution of differential equation $\frac{d^2y}{dx^2} + y = 0$, under initial condition

$$\left(\frac{dy}{dx}\right)_{x=0} = 1, y(0) = 1 \text{ is :}$$

- (A) 2 (B) 1
(C) $\sqrt{2}$ (D) $1/\sqrt{2}$.

58. Which of the following set is a basis for the subspace

$$W = \left\{ \begin{bmatrix} x & y \\ 0 & t \end{bmatrix} : x + 2y + t = 0, y + t = 0, x, y, t \in \mathbb{R} \right\}$$

of the vector space of all 2×2 real matrices?

- (A) $\left\{ \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \right\}$ (B) $\left\{ \begin{bmatrix} -1 & 1 \\ 2 & -1 \end{bmatrix} \right\}$
(C) $\left\{ \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \right\}$ (D) $\left\{ \begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix}, \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix} \right\}$.

59. Let \mathbb{Q}, \mathbb{R} and \mathbb{C} are field of rational, real and complex numbers respectively. Then which of the algebraic structure is not a vector space?

- (A) $\mathbb{C}(\mathbb{C})$ (B) $\mathbb{Q}(\mathbb{R})$
(C) $\mathbb{R}(\mathbb{Q})$ (D) $\mathbb{C}(\mathbb{R})$.

60. The residue of the function $f(z) = \frac{z}{(z+1)(z-2)}$ at $z = 2$ is :

- (A) 1 (B) 0
(C) 2 (D) $\frac{2}{3}$.

61. If the radial velocity is proportional to the transverse velocity, then the path in polar coordinates is :

(A) $r = Be^{k\theta}$

(B) $r = \theta$

(C) $r = 1$

(D) $r = 2.$

62. Let A be a 2×2 matrix such that $\text{trace}(A) = \det(A) = 2024$. What is trace of A^{-1} ?

(A) 2024

(B) 1

(C) $\frac{1}{2}$

(D) $\frac{1}{2024}.$

63. If $T : \mathbb{R}^{2025} \rightarrow \mathbb{R}^{2025}$ be a linear transformation such that nullity (T) = 1, then rank of T is :

(A) 2025

(B) 2024

(C) 2022

(D) 2021.

64. The two dimensional Laplace equation is :

(A) Parabolic

(B) Hyperbolic

(C) Elliptic

(D) None of these.

65. Which of the following sequence is not convergence?

(A) $a_n = \frac{(-1)^n}{n}$

(B) $a_n = \frac{(-1)^n}{n^2}$

(C) $a_n = \frac{n}{n+1}$

(D) $a_n = 1 + \frac{1}{3} + \frac{1}{5} + \dots + \frac{1}{2n-1}.$

66. Which of the following real valued function is not continuous on \mathbb{R} :

(A) $f(x) = e^{\sin x}$

(B) $f(x) = e^{x^2}$

(C) $f(x) = \begin{cases} x \sin \frac{1}{x}; & x \neq 0 \\ 0 & ; \quad x = 0 \end{cases}$

(D) $f(x) = \begin{cases} \sin \frac{1}{x}; & x \neq 0 \\ 0 & ; \quad x = 0 \end{cases}$

67. If d is a metric on X , then which one of the following is not a metric on X .

(A) $2d(x, y)$

(B) $\frac{d(x, y)}{1 + d(x, y)}$

(C) $\text{Min}\{1, d(x, y)\}$

(D) $-2d(x, y)$.

68. Which of the following define a metric on \mathbb{R} ?

(A) $d(x, y) = \frac{|x - y|}{1 + |x - y|}$

(B) $d(x, y) = |x^2 - y^2|$

(C) $d(x, y) = |x^4 - y^4|$

(D) $d(x, y) = |x - 2y| + |2y - x|$.

69. Choose the correct statement :

(A) $\sum \sin \frac{1}{n}$ is divergent

(B) $\sum \sin \frac{1}{n^2}$ is divergent

(C) $\sum \frac{1}{n^2}$ is divergent

(D) $\sum \frac{1}{n}$ is convergent.

70. If $f(x) = \begin{cases} 1; & x \in \mathbb{Q} \cap [-1, 1] \\ -1; & x \in (\mathbb{R} \setminus \mathbb{Q}) \cap [-1, 1] \end{cases}$ then choose the correct statement :

(A) f is Riemann integrable

(B) f is not Riemann integrable

(C) The lower Riemann integrable of f is 1

(D) The upper Riemann integrable of f is -1 .

ROUGH WORK