INDIAN SCHOOL AL WADI AL KABIR

SECOND REHEARSAL EXAMINATION

MATHEMATICS - Code No. 041

Class-XII-(2025-26)

SET: 1

Time allowed: 3 Hrs. **Maximum Marks: 80**

General Instructions:

Read the following instructions very carefully and follow them:

1. This question paper contains 38 questions. All questions are compulsory.
2. This question paper is divided into 5 sections - A, B, C, D and E
3. Section A comprises of 20 MCQ type questions of 1 mark each.
4. Section B comprises of 5 Very Short Answer Type Questions of 2 marks each
5. Section C comprises of 6 Short Answer Type Questions of 3 marks each.
6. Section D comprises of 4 Long Answer Type Questions of 5 marks each.
7. Section E comprises of 3 source based / case based / passage-based questions (4 marks each) with sub parts.
8. Internal choice haves been provided for certain questions
9. This question paper contains 6 pages

Q. No.	Section – A	Marks
1	If $\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}\begin{bmatrix}3 & 1\\2 & 5\end{bmatrix} = \begin{bmatrix}7 & 11\\k & 23\end{bmatrix}$, then the value of *k* is a) -13 b) 13 c) -17 d) 17	(1m)
2	Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let F = 4x + 6y be the objective function. The Minimum value of F occurs at a) (0, 2) only b) (3, 0) only c) the mid-point of the line segment joining the points (0, 2) and (3, 0) only d) any point on the line segment joining the points (0, 2) and (3, 0).	(1m)
3	If A = $\begin{bmatrix}0 & 1\\0 & 0\end{bmatrix}$, then A^{2025} is a) $\begin{bmatrix}0 & 0\\0 & 0\end{bmatrix}$ b) $\begin{bmatrix}0 & 1\\0 & 0\end{bmatrix}$ c) $\begin{bmatrix}0 & 2025\\0 & 0\end{bmatrix}$ d) $\begin{bmatrix}0 & 2025\\2025 & 0\end{bmatrix}$	(1m)

4 The sum of the order and the degree of the differential equation $\sqrt{\frac{d^2y}{dx^2}} = \sqrt[3]{\frac{dy}{dx} + 3}$ (1m)

a) 2 b) 3 c) 4 d) 5

5 The value of $(\hat{\imath} \times \hat{\jmath}).\hat{k} + (\hat{\jmath} \times \hat{k}).\hat{\imath} + (\hat{k} \times \hat{\imath}).\hat{\jmath}$ is (1m)

a) 0 b) -1 c) 1 d) 3

6 If A is a non-singular matrix of order 3 and |A| = – 4, then |adj A|: (1m)

a) $\frac{1}{4}$ b) 4 c) 16 d) 64

7 If A and B are two independent events with P(A) = $\frac{3}{5}$ and P(B) = $\frac{4}{9}$, then find P $(\overline{A} \cap \overline{B})$ (1m)

a) $\frac{1}{9}$ b) $\frac{2}{9}$ c) $\frac{4}{9}$ d) $\frac{1}{3}$

8 The Integrating factor of the differential equation $\frac{dy}{dx}$ + 2y cot x = 3x^2 cosec x is (1m)

a) 2 cot x b) 3 cosec x c) $\sin^2 x$ d) $\cos^2 x$

9 If A is a square matrix of order 3 such that |A| = - 5, then value of |-AA’| is (1m)

a) -125 b) -25 c) 25 d) 125

10 The vector equation of a line which passes through the point (2, - 4, 5) and is parallel to the line $\frac{x+3}{3} = \frac{4-y}{2} = \frac{z+8}{6}$ is (1m)

a) $\vec{r} = (-2\hat{\imath} + 4\hat{\jmath} - 5\hat{k}) + \lambda\,(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$
c) $\vec{r} = (2\hat{\imath} - 4\hat{\jmath} + 5\hat{k}) + \lambda\,(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$
b) $\vec{r} = (2\hat{\imath} - 4\hat{\jmath} + 5\hat{k}) + \lambda\,(3\hat{\imath} - 2\hat{\jmath} + 6\hat{k})$
d) $\vec{r} = (-2\hat{\imath} + 4\hat{\jmath} - 5\hat{k}) + \lambda\,(3\hat{\imath} - 2\hat{\jmath} - 6\hat{k})$

11 The value of $\int_0^{2\pi} \frac{1}{e^{\sin x}+1}\,dx$ is (1m)

a) 0 b) $\frac{\pi}{2}$ c) π d) 3π

12 If y = $\tan^{-1}\sqrt{\frac{1-\cos x}{1+\cos x}}$, then the value of $\frac{dy}{dx}$: (1m)

a) - $\frac{1}{2}$ b) $\frac{1}{2}$ c) 1 d) - 1

13 The value of $\int_1^2 \frac{1}{x\sqrt{x^2-1}}\,dx$ is (1m)

a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

14 The cofactor of a_{12} in $\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{bmatrix}$ (1m)

a) - 46 b) 0 c) 1 d) 46

15 The projection of the vector $2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ on the vector $\hat{\imath} + 2\hat{\jmath} + \hat{k}$ is (1m)

a) $\frac{5}{\sqrt{6}}$ b) $\frac{5}{\sqrt{3}}$ c) $\frac{10}{\sqrt{3}}$ d) $\frac{10}{\sqrt{6}}$

16 If $\begin{vmatrix} 4 & 1 \\ 2 & 1 \end{vmatrix}^2 = \begin{vmatrix} 3 & 2 \\ 1 & x \end{vmatrix} - \begin{vmatrix} x & 3 \\ -2 & 1 \end{vmatrix}$, then the value of x is (1m)

a) 1 b) 3 c) 6 d) 7

17 A stone is dropped into a quiet lake and waves move in circles at a speed of 4cm per second. At the instant, when the radius of the circular wave is 10 cm, how fast is the enclosed area increasing? (1m)

a) 80π b) 40π c) 20π d) 10π

18 In an LPP, the objective function is always: (1m)

a) linear b) quadratic c) cubic d) biquadratic

Directions: In the following 2 questions, A statement of Assertion (A) i-s followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is NOT the correct explanation of A

(C) A is true but R is false

(D) A is false and R is True

19 **Assertion:** If the cartesian equation of a line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$ then its vector form is (1m)

$\vec{r} = (5\hat{\imath} - 4\hat{\jmath} + 6\hat{k}) + \lambda\,(3\hat{\imath} + 7\hat{\jmath} + 2\hat{k})$

Reason: The cartesian equation of the line which passes through the point (–2, 4, –5) and parallel to the line given by $\frac{x-3}{3} = \frac{y-4}{5} = \frac{z+8}{6}$ is $\frac{x+3}{-2} = \frac{y-4}{4} = \frac{z+8}{-5}$

20 **Assertion:** The value of expression $\sec^{-1}\left(\frac{2}{\sqrt{3}}\right) + \tan^{-1}(1) + \sin^{-1}\left(\frac{1}{2}\right)$ is $\frac{\pi}{4}$ (1m)

Reason: The Principal value branch of $\sin^{-1}x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and that of $\sec^{-1}x$ is $[0, \pi] - \left\{\frac{\pi}{2}\right\}$

Section - B

21 (a) Find $|\vec{x}|$ if $(\vec{x} - \vec{a})\,(\vec{x} + \vec{a}) = 12$, where $\vec{a}$ is a unit vector. (2m)

- OR -

(b) If $\vec{a} = 5\hat{\imath} - \hat{\jmath} + 7\hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \lambda\hat{k}$, then find the value of λ so that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are orthogonal.

22 Find the value(s) of 'k' so that the function $f(x) = \begin{cases} \frac{1-\cos kx}{x \sin x}, & if\ x \neq 0 \\ \frac{1}{2}, & if\ x = 0 \end{cases}$ is continuous at x = 0 (2m)

23 Differentiate with respect to x: $x^{sinx} + 2^{sinx}$. (2m)

24 Find the domain of $sin^{-1}(x^2 - 3)$. (2m)

25 (a) Evaluate $\int \frac{1}{9x^2 + 6x + 5} dx$ (2m)

- OR -

(b) Evaluate $\int_1^4 |x - 3| \, dx$

Section - C

26 (a) If x = a sin 2t (1 + cos 2t) and y = b cos 2t (1 – cos 2t), then show that $\left(\frac{dy}{dx}\right)_{t=\frac{\pi}{4}} = \frac{b}{a}$ (3m)

- OR -

(b) Find the derivative of the function given by $y = (1 + x)(1 + x^2)(1 + x^4)(1 + x^8)$ and hence evaluate $\frac{dy}{dx}$ at x = 1

27 Using integration, find the area bounded by the curve $x^2 = 4y$ and the lines y =0 and y=3. (3m)

28 (a) Using integration, find the area of region bounded by the line $y = \sqrt{3}x$, the curve $y = \sqrt{4 - x^2}$ and y axis in the first quadrant. (3m)

- OR -

(b) Find the area of the region bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = -1$ and $x = 1$.

29 (a) Find the points on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point P(1, 3, 3). (3m)

- OR -

(b) Find the vector equation of the line through the point (1, 2, –4) and perpendicular to the two lines $\vec{r} = (8\hat{\imath} - 19\hat{\jmath} + 10\hat{k}) + \lambda(3\hat{\imath} - 16\hat{\jmath} + 7\hat{k})$ and $\vec{r} = (15\hat{\imath} + 29\hat{\jmath} + 5\hat{k}) + \mu(3\hat{\imath} + 8\hat{\jmath} - 5\hat{k})$

30 Minimize and maximize Z = 600x + 400y by graphical method subject to the constraints: (3m)
$x + 2y \leq 12$; $2x + y \leq 12$; $4x + 5y \geq 20$; $x \geq 0$; $y \geq 0$

31 Anushka, Anusree and Benazir appeared for an interview for three vacancies in the same post. The probability of Anushka's selection is $\frac{1}{5}$, Anusree's selection is $\frac{1}{3}$ and Benazir's selection is $\frac{1}{4}$. The event of selection is independent of each other. Based on the above information, answer the following questions: (3m)

(i) Find $P(G|\overline{H})$ where G is the event of Anusree 's selection and $\overline{H}$ denotes the event that Anushka is not selected.

(ii) Find the probability that exactly one of them is selected.

Section - D

32 Find the shortest distance between the lines (5m)

$\vec{r} = (4\hat{\imath} - \hat{\jmath}) + \lambda(\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$ and $\vec{r} = (\hat{\imath} - \hat{\jmath} + 2\hat{k}) + \mu(2\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$

33 (a) (i) Evaluate: $\int_0^{\pi} \frac{x}{1+\sin x}\, dx$ (5m)

(ii) Evaluate: $\int e^x \frac{(1-\sin x)}{(1-\cos x)}\, dx$

\- OR -

(b) Evaluate $\int \frac{x^4}{(x-1)(x^2+1)}\, dx$

34 (a) Solve the differential equation: $(x^2 + y^2)\, dx - 2xy dy = 0$ (5m)

\- OR -

(b) Find the general solution of the following differential equation; $x\, dy - (y + 2x^2)\, dx = 0$

35 The management committee of a residential colony decided to award some of its members (say x) for honesty, some (say y) for helping others and some others (say z) for supervising the workers to keep the colony neat and clean. The sum of all the awardees is 12. Three times the sum of awardees for helping others and supervision added to two times the number of awardees for honesty is 33. If the sum of the number of awardees for honesty and supervision is twice the number of awardees for helping others, using matrix method, find the number of awardees of each category. (5m)

Section - E

36 A MOTO GT organization conducted bike race under two different categories - Boys and Girls. There were 28 participants in all. Among all of them, finally three from category 1 and two from category 2 were selected for the final race. Ravi forms two sets B and G with these participants for his college project.

Let B = $\{b_1, b_2, b_3\}$ and G = $\{g_1, g_2\}$, where B represents the set of Boys selected and G the set of Girls selected for d for the final race.

(i) How many relations are possible from B to G? (1m)

(ii) Among all the possible relations from B to G, how many functions can be formed from B to G? (1m)

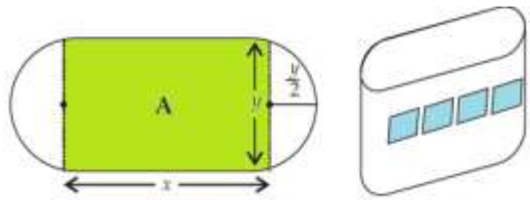
(2m)

(iii) (a) Let R : B → B be defined by R ={(x, y) : x and y are students of the same sex}.
Check if R is an equivalence relation in B or not.

- OR -

(b) A function f : B → G be defined by f ={(b_1, g_1), (b_2, g_2), (b_3, g_1)}.
Check if f is bijective, Justify your answer.

37 Read the following passage and answer the questions given below. An architect designs a building for a multinational company. The floor consists of a rectangular region with semicircular ends having a perimeter of 200 m as shown here:



Design of Floor *Building*

(i) If x and y represent the length and breadth of the rectangular region, then find the relation between the variable. (1m)

(ii) Find the area of the rectangular region A expressed as a function of x. (1m)

(iii) (a) Find the maximum value of area A. (2m)

- OR -

(b) The CEO of the multi-national company is interested in maximizing the area of the whole floor including the semi-circular ends. Find the value of x for this to happen.

38 Mahindra Tractors is India's leading farm equipment manufacturer. It is the largest tractor selling factory in the world. This factory has two machine A and B. Past record shows that machine A produced 60% and machine B produced 40% of the output(tractors). Further 2% of the tractors produced by machine A and 1% produced by machine B were defective. All the tractors are put into one big store hall and one tractor is chosen at random.

(i) Find the total probability of chosen tractor (at random) is defective. (2m)

(ii) If in random choosing, chosen tractor is defective, then find the probability that the chosen tractor is produced by machine 'B' (2m)