INDIAN SCHOOL AL WADI AL KABIR
Assessment – 1 (2025 – 2026)

Class: XII Sub: MATHEMATICS (041) Max Marks: 80
Date: 23.09.2025 Set – I Time: 3 hrs

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

SECTION – A
(Each MCQ Carries 1 Mark)

1 Let A = {a, b, c} and let R = {(a, a), (a, b), (b, a)}. Then, R

a) reflexive and symmetric but not transitive   b) an equivalence relation

c) symmetric but neither transitive nor reflexive   d) reflexive and transitive but not symmetric

2 Let X = {x^2 : x ∈ N} and the relation f : N → X is defined by $f(x) = x^2$, x ∈ N. Then, this function is

a) not bijective   b) injective only   c) surjective only   d) bijective

3 The principal value of $\cot^{-1}$ (-1) is

a) $\frac{5\pi}{4}$ b) $\frac{-\pi}{4}$ c) $\frac{\pi}{4}$ d) $\frac{3\pi}{4}$

4 If y = $\tan^{-1}\sqrt{\frac{1-\sin x}{1+\sin x}}$ then the value of $\frac{dy}{dx}$ at x = $\frac{\pi}{6}$ is

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

5 If f(x) = $\begin{cases} \frac{kx}{|x|}, & if\ x < 0 \\ 3, & if\ x \geq 0 \end{cases}$ is continuous at x = 0, then the value of k is:

a) -3   b) 0   c) 3   d) any real number

6 Let A = {a, b, c} and the relation R be defined on A as R = {(a, a), (b, c), (a, b)}. Then, find minimum number of ordered pairs to be added in R to make R reflexive and transitive

a) 2   b) 4   c) 1   d) 3

7   If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx}$ is

 a) e^{y-x} b) e^{x+y} c) $- e^{y-x}$ d) $2e^{y-x}$

8   If y = 5cos x - 3sin x, then $\frac{d^2y}{dx^2}$ is equal to

 a) y   b) - y   c) 9y   d) 25y

9   If the sides of a square are decreasing at the rate of 1·5cm/s, the rate of decrease of its perimeter is

 a) 1·5 cm/s   b) 6 cm/s   c) 3 cm/s   d) 2.25 cm/s

10    $\int x^2\, e^{x^3}\, dx$ equals to

 a) $\frac{1}{3} e^{x^3} + c$ b) $\frac{1}{3} e^{x^4} + c$ c) $\frac{1}{2} e^{x^3} + c$ d) $\frac{1}{2} e^{x^2} + c$

11   If A is a Square matrix of order 3 such that the value of $|adj.\ A| = 8$, then the value $|A^T|$ is

 a) $2\sqrt{2}$ b) $- 2\sqrt{2}$ c) $\pm 2\sqrt{2}$ d) None of these

12    $\int \frac{sin^2x - cos^2x}{sin^2x .\ cos^2x}\, dx = $ _____

 a) tan x + cot x + c   c) tan x - cot x + c

 b) tan x . cot x + c   d) $- 2$ cot 2x + c

13   In the given determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$, the value of the element at position of a_{32} x A_{32} , where A_{32} is the cofactor of the element $a_{32.}$

 a) 5   b) 22   c) 110   d) None of these

14   If $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} + X = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$, where $X = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $a + b - c - d$ is

 a) 1   b) 2   c) 3   d) 5

15   If the sum of all the elements of a 3×3 scalar matrix is 9, then the product of all its elements

 a) 729   b) 27   c) 9   d) 0

16   If the area of the triangle with vertices $(-3,0)$, $(3,0)$ and $(0,k)$ is 9sq.units, then the values of 'k' will be:

 a) ± 3 b) ± 6 c) ± 9 d) ± 1

17   A is a skew-symmetric matrix and a matrix B such that B^TAB is defined, then B^TAB is a

 a) symmetric matrix   c) Diagonal matrix

 b) upper triangular symmetric   d) skew-symmetric matrix

18 $\int \frac{1}{x^2+2x+2} dx$ is

    a) x. tan⁻¹(x+1) + C   c) (x+1) tan⁻¹(x+1) + C

    b) tan⁻¹(x+1) + C   d) tan⁻¹ x + C

Directions: In the following 2 questions, A statement of Assertion (A) is 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 (A):** Domain of y = cos⁻¹(x) is [-1, 1]

    Reason (R): The range of the principle value branch of y = cos⁻¹(x) is $[0, \pi] - \left(\frac{\pi}{2}\right)$

20 **Assertion (A):** Let f(x) be a polynomial function of degree 6 such that

$$\frac{d}{dx}(f(x)) = (x-1)^3 (x-3)^3,$$ then f(x) has minimum at x = 1

    Reason (R): When $\frac{d}{dx}(f(x)) < 0$, ∀ x ∈ (a – h, a) and when $\frac{d}{dx}(f(x)) > 0$, ∀ x ∈ (a, a + h); where '*h*' is very small positive quantity, then f(x) has a minimum at x = a, provided f(x) is continuous at x = a

SECTION – B
(Each Question Carries 2 Marks)

21 Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$. Find a matrix D such that CD – AB = 0

22 (a) Evaluate $\int \frac{1}{\cos(x-a) \cdot \cos(x-b)} dx$

    - OR -

    (b) Evaluate $\int \sqrt{x^2 + 2x + 5} \ dx$

23 (a) Sketch the graph of cos⁻¹ (x)

    - OR -

    (b) Evaluate $\sin^{-1}\left(\sin\left(\frac{3\pi}{4}\right)\right) + \cos^{-1}(\cos\pi) + \tan^{-1}(1)$

24 Show that R is an equivalence relation on the set Z of integers given by R = {(a, b): 2 divides a – b}. and write the equivalence class {0}.

25 If x = a cos θ, y = b tan θ, then find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$

SECTION – C
(Each Question Carries 3 Marks)

26 If $y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$, then prove that $\frac{dy}{dx} = -\sqrt{\frac{1-y^2}{1-x^2}}$

27 (a) Integrate the function $\int tan^{-1}x \, dx$

- OR -

(b) Evaluate $\int e^x \left(\frac{1+\sin x}{1+\cos x}\right) dx$

28 A window is of the form of a semi-circle with a rectangle on its diameter. The total perimeter of the window is 10 m. Find the dimensions of the window to admit maximum light through the whole opening.

- OR -

An open tank with a square base and vertical sides is to be constructed from a metal sheet so as to hold a given quantity of water. Show that the cost of material will be least when depth of the tank is half of its width.

29 If $f(a) = \begin{bmatrix} \cos a & -\sin a & 0 \\ \sin a & \cos a & 0 \\ 0 & 0 & 1 \end{bmatrix}$ then prove that $f(\alpha).f(\beta) = f(\alpha - \beta)$

- OR -

If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then show that $A^2 - 5A + 7I = O$, hence find A^{-1}

30 Express the matrix $A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix.

31 Find the intervals in which the function $f(x) = \frac{x^4}{4} - x^3 - 5x^2 + 24x + 12$ is
(a) Strictly increasing   (b) Strictly decreasing

SECTION – D
(Each Question Carries 5 Marks)

32 Using matrix method, solve the system of equations

A shopkeeper has 3 varieties of pens 'A', 'B' and 'C'. Meena purchased 1 pen of each variety for a total of ₹21. Jeevan purchased 4 pens of 'A' variety, 3pens of 'B' variety and 2 pens of 'C' variety for ₹60, while Shikha purchased 6 pens of 'A' variety 2 pens of 'B' variety and 3 pens of 'C' variety for ₹70. Using matrix method, find the cost of each variety of pen.

33 A function $f: [-4, 4] \to [0, 4]$ is given by $f(x) = \sqrt{16 - x^2}$. Show that f is an onto function but not a one-one function. Further, find all possible values of 'a' for which $f(a) = \sqrt{7}$.

34 (a) If $y = Ae^{mx} + Be^{nx}$, then show that $\dfrac{d^2y}{dx^2} - (m + n)\dfrac{dy}{dx} + mny = 0$

    - OR -

    (b) Differentiate $(\log x)^x + x^{\log x}$ with respect to x.

35 (a) Evaluate $\int \dfrac{5x - 2}{1 + 2x + 3x^2}\ dx$

    - OR -

    (b) Evaluate $\int \dfrac{(x^2 + 1)(x^2 + 2)}{(x^2 + 3)(x^2 + 4)}\ dx$

## SECTION – E
(CASE STUDY - Each Question Carries 4 Marks)

36 Students of a school are taken to a railway museum to learn about railway heritage and its history. An exhibit in the museum depicted many rail lines on the track near the railway station. Let 'L' be the set of all rail lines on the railway track and 'R' be the relation on 'L' defined by

R = {(l₁, l₂): l₁ is parallel to l₂)}

On the basis of the above information, answer the following questions

$R = \{(l_1, l_2): l_1 \text{ is parallel to } l_2)\}$

(i) Find whether the relation R is Symmetric or not.   (2m)

(ii) If one of the rail lines of the railway track is represented by the equations $y = 3x + 2$, then find the set of rail lines in R related to it.   (2m)

37 Over speeding increases fuel consumption and decreases fuel economy as a result of tyre rolling friction and air resistance. While vehicles reach optimal fuel economy at different speeds, fuel mileage usually decreases rapidly at speeds above 80 km/h. The relation between fuel consumption F and speed V under some constraints is given as $F = \dfrac{V^2}{500} - \dfrac{V}{4} + 14$. On the basis of the above information, answer the following questions:
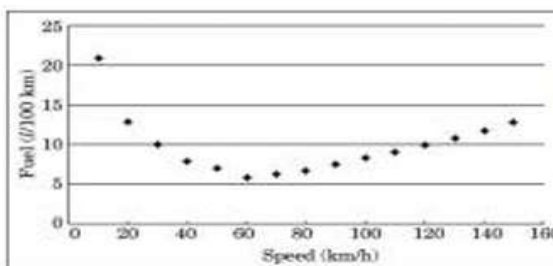
(i) Find F when V is 40   (1m)

(ii) Find $\dfrac{dF}{dV}$ (1m)

(iii) (a) Find the speed V for which fuel consumption F is minimum   (2m)

   - OR -

   (b) Find the quantity of fuel required to travel 600km at the speed V at which $\dfrac{dF}{dV} = -0.01$

                                                                                   (2m)

38 The monthly incomes of two sister Rita and Ritika are in the ratio 3 : 4 and their monthly expenditures are in the ratio 5 : 7. Each sister saves ₹ 15,000 per month

   (i)   What is the system of linear equations representing the given information about the monthly income of Rita and Ritika are ₹3x and ₹4x, respectively and their monthly expenditures are ₹5y and ₹7y, respectively   (1m)

   (ii)   Write the matrix equation representing the given system of linear equations?   (1m)

   (iii) What is the monthly income of Rita and Ritika?   (2m)

      -   OR -

      If A = $\begin{bmatrix} 3 & -5 \\ 4 & -7 \end{bmatrix}$ then what is the value of A^{-1}?   (2m)

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