DAV PUBLIC SCHOOLS

JHARKHAND ZONE-K

HALF YEARLY EXAMINATION SESSION - 2025-26

CLASS - XII **TIME : 3 Hrs**

SUBJECT - MATHEMATICS **MAXIMUM MARKS: 80**

GENERAL INSTRUCTIONS:

1. **This question paper contains five sections A, B, C, D and E. Each section is compulsory. However, there are internal choice in some questions.**
2. **Section A has 18 MCQ's and 2 Assertion-Reason based questions of 1 mark each.**
3. **Section B has 5 Very Short Answer (VSA) type questions of 2 marks each.**
4. **Section C has 6 Short Answer (SA) type questions of 3 marks each.**
5. **Section D has 4 Long Answer (LA) type questions of 5 marks each.**
6. **Section E has 3 source based/case based questions of four marks each with sub parts.**
7. **15 minutes time has been allotted to read the question paper.**

Section – A

Each question carries 1 mark

1. The number of equivalence relations in the set{1,2,3} containing the elements (1,2) and (2,1) is

(a)0 (b)1 (c)2 (d)3

2. The function f:R⟶R defined as f(x)=x^3 is

(a) One-One but not onto

(b) not one one but onto

(c) Niether one one nor onto

(d) One-one and onto

3.Let f:R⟶R be defined by f(x)=$\frac{1}{x}$,for all x ∈ R,Then f is

(a)Injective (b)Not defined (c)Surjective (d)Bijective

4.The domain of the function $\cos^{-1}(2x-1)$ is

(a)[0,1] (b)[-1,1] (c)(-1,1) (d)[0,Π]

5. The value of the expression $2\sec^{-1}2+\sin^{-1}\frac{1}{2}$ is

(a)$\frac{\pi}{6}$ (b)$5\frac{\pi}{6}$ (c) $7\frac{\pi}{6}$ (d)1

6. If A and B are square matrices of same order then $(AB^T - BA^T)$ is

(a)skew symmetric matrix (b)unit matrix

(c)null matrix (d)symmetric matrix

7. If A=$\begin{bmatrix}1 & 0\\ 2 & 1\end{bmatrix}$, B=$\begin{bmatrix}x & 0\\ 1 & 1\end{bmatrix}$ and A=B^2,then x equals

(a)±1 (b)-1 (c)1 (d)2

8. If $|A|=|KA|$, where A is a square matrix of order 2,then sum of all possible value of K is

(a) 1 (b)-1 (c)2 (d)0

9.If A is square matrix of order 2 such that det(A)=4,then det(4adjA) is equal to:

(a)16 (b)64 (c)256 (d)512

10.If sin y =x cos(a+y) then $\frac{dx}{dy}$ is

(a)$\frac{\cos a}{cos^2(a+y)}$ (b) $-\frac{\cos a}{cos^2(a+y)}$ (c)$\frac{\cos a}{sin^2 y}$ (d)$-\frac{\cos a}{sin^2(y)}$

11. The function f(x)=x$|x|$ is

(a) continuous but not differentiable at x=0

(b)differentiable but not continuous at x=0

(c)continuous and differentiable at x=0

(d) neither continuous nor differentiable at x=0.

12.If y=e^{-x} then $\frac{d^2y}{dx^2}$ is equal to

(a)-y (b)y (c)x (d)-x

13.If y=$x^{\frac{1}{x}}$, then $\frac{dy}{dx}$ at x=1 is equal to

(a)$\frac{1}{x}.x^{\frac{1}{x}-1}$ (b)0 (c)1 (d) not defined

14.If x=at^2,y=2at,then $\frac{d^2y}{dx^2}$ is equal to

(a)$\frac{1}{2at^3}$ (b)at^3 (c)-at^3 (d)-$\frac{-1}{2at^3}$

15. If $x^m y^n = (x+y)^{m+n}$ then $\frac{dy}{dx}$ is

(a)$\frac{x}{y}$ (b) $\frac{y}{x}$ (c)- $\frac{x}{y}$ (d)- $\frac{y}{x}$

16.If xe^y=1 then the value of $\frac{dy}{dx}$ at x=1 is

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

17.$\int \frac{1}{x(logx)^2}$ dx is equal to

(a)2log(log x)+C (b)-$\frac{1}{\log x}$+C (c)$\frac{(\log x)^3}{3}$+C (d)$\frac{3}{(\log x)^3}+C$

18.The value of $\int_2^3 \frac{x}{x^2+1}$ dx is

(a) log4 (b)log$\frac{3}{2}$ (c)$\frac{1}{2}$log 2 (d)log$\frac{9}{4}$

Assertion -Reason Based question

The following question consists of two statements -Assertion(A) and Reason(R).Answer these questions selecting the appropriate option given below.

(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 for A.
(c) A is true but R is false.
(d) A is false but R is true.

19.Assertion(A):$\int \frac{1}{2\sqrt{x}}$dx=$\sqrt{x}+C$

Reason (R):$\int \cos x$ dx=sin x+C

20.Assertion(A):If y= $\sin^{-1}\frac{2x}{1+x^2}$,then $\frac{dy}{dx}=\frac{x}{1+x^2}$

Reason (R): $\sin^{-1}\frac{2x}{1+x^2}=2\tan^{-1}x$ and $\frac{d}{dx}(\tan^{-1}x)=\frac{1}{1+x^2}$.

Section: B

This section comprises of VSA (veru short answer)type of question of 2 mark each

21. Find value of K if $\sin^{-1}\left[K\tan\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]=\frac{\pi}{3}$.

OR

Consider f:$R_+\longrightarrow$[4,∞) given by f(x)=x^2+4.Show that f is bijective.

22. Find the interval in which the function f(x)=cos 3x,x$\in\left(0,\frac{\pi}{2}\right)$ is
(a)increasing(b)decreasing

23. If the area of the triangle is 35sq. units with vertices with vertices (2,-6),(5,4) and (K,4).Find the value of K.

OR

Find the equation of a line joining (1,2) and (3,6) using determinants.

24. Evaluate $\int \frac{1}{1-\tan x}\, dx$

25. If $y=x^x$ then prove that $\frac{d^2y}{dx^2} - \frac{1}{y}(\frac{dy}{dx})^2 - \frac{y}{x} = 0$.

Section: C

This section comprises of SA type questions of 3 marks each

26. Differentiate w.r.t x: $\sin^{-1}\left(\frac{2^{x+1}.3^x}{1+(36)^x}\right)$.

27 .Evaluate $\int(\log(logx) + \frac{1}{(\log x)^2})dx$

OR

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

28. Evaluate $\int_0^{\frac{\pi}{4}} \log(1 + tanx)\, dx$

OR

Evaluate $\int_0^5 (|x-1| + |x-2| + |x-5|)dx$

29. Show that the function f(x)=$|x-3|$,x€R is continuous but not differentiable at x=3.

OR

Find the value of a and b such that the function defined by

$$f(x)=\begin{cases} 5 & if\ x \le 2 \\ ax+b, & if\ \ 2 < x < 10 \\ 21 & , \quad if\ x \ge 10 \end{cases}$$ is a continuous function.

30. If $A=\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ show that A^2 -5A+7I=0Hence find A^{-1}.

31. Express the following matrix as the sum of a symmetric and a skew symmetric matrix:

$$\begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}.$$

Section: D

This section comprises of LA type questions of 5 mark each.

32 .Find the area of the region bounded by the curve $4x^2+y^2=36$ using integration.

OR

Sketch the graph y=$|x+1|$.Evaluate $\int_{-3}^{1}|x+1|dx$.What does this value represent on the graph.

33. Show that each of the relation R in the set A=$\{x \in z: 0 \leq x \leq 12\}$,given by R =$\{(a,b):|a-b| \; is \; multiple \; of \; 4\}$ is an equivalence relation.Find the set of all elements related to 2.

34. Prove that the volume of the largest cone that can be inscribed in the sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.

OR

Find the intervals in which the function f given by f(x)= (sinx-cos x), x$\in[0,2\pi]$ is strictly increasing or decreasing .

35. Solve the following system of equations using matrix method

2x+3y+3z=5

x-2y+z= - 4

3x-y-2z=3

Section-E

Case Based/Data Based

Each of the following questions are of 4 mark each.

36.Read the following passage and answer the following questions.

Let f(x) be a real valued function.Then its

Left Hand Derivative(LHD) .Lf′a=$\lim_{h\to 0}\frac{f(a-h)-f(a)}{-h}$

Right Hand Derivative(RHD):Rf′a=$\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$.

Also, a function f(x) is said to be differentiable at x=aif its LHD and RHD at x=a exists and both are equal.

For the function f(x)=$\begin{cases}|x-3| & ,x \geq 1 \\ \frac{x^2}{4}-\frac{3x}{2}+\frac{13}{4} & ,x<1.\end{cases}$

(i) What is the RHD of f(x) at x=1?

(ii) What is the LHD of f(x) at x=1?

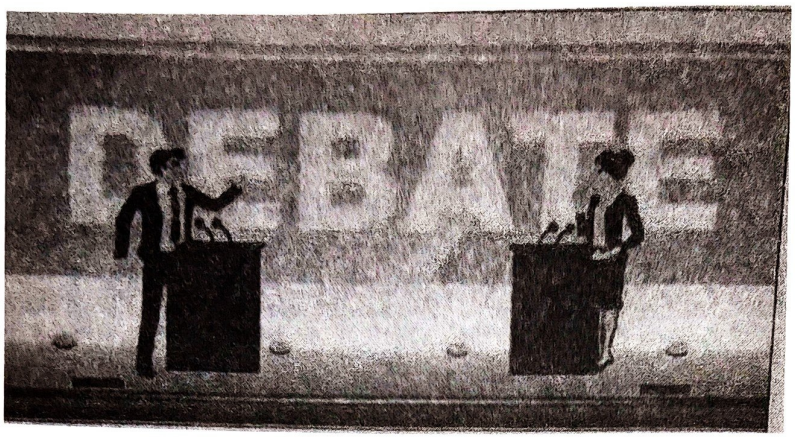
(iii) (a)Check if the function f(x) is differentiable at x=1.

OR

(b)Find f′ (2) and f′ (-1).

37. A school is organizing a debate competition with participants as speakers S=$\{S_1, S_2, S_3, S_4\}$ and these are judges J=$\{J_1, J_2, J_3$.Each speaker can be assigned one

judge.Let R be the relation from set S to J defined by R={(x,y):speaker x is judjed by judge y , x∈S,y∈ J}.



Based on the above answer the following:

(i) How many relations can be there from S to J?

(ii) A student identifies a function from S to J as f={$(S_1,J_1),(S_2,J_2),(S_3,J_2),(S_4,J_3)$}.Check if it is bijective.

(iii) (a) How may one-one functions can be there from set S to set J?

OR

(iv) (b)Another student consider a relation R_1={$(S_1,S_2),(S_2,S_4)$} in set S.Write minimum ordered pairs to be included in R_1 so that $R_1$is reflexive but not symmetric.

38.

A small town in analyzing the pattern of a newstreet light installation.The lights are set up in such a way that the intensity of light at any point x metres from the start of the street can be modelled by f(x)=e^x sinx ,where x is in metres.

Based on the above ,answer the following:

(i) Find the intervals on which the f(x) is increasing or decreasing,x∈ $[0,\pi]$.

(ii) Verify whether each critical point when x∈ $[0,\pi]$ is a point of local maximum or local minimum or a point of inflexion.

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