Directorate of Education, GNCT of Delhi

Practice Paper

(2024-25)

Class – XII

Mathematics (Code: 041)

Time: 3 hours **Maximum Marks: 80**

General Instructions :

Read the following instructions very carefully and strictly follow them:

1. This Question paper contains 38 questions divided into **five sections A,B,C,D,E**. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has question number (1-18) as **MCQ's and Question number (19-20)** Assertion-Reason based questions of 1 mark each.
3. **Section B** has Question number (21-25) of **Very Short Answer (VSA)-type** questions of 2 marks each.
4. **Section C** has Question number (26-31) of **Short Answer (SA)-type** questions of 3 marks each.
5. **Section D** has Question number (32-35) of **Long Answer (LA)-type** questions of 5 marks each.
6. **Section E** has Question number (36-38) **of Source based/Case based/passage based/integrated units of assessment questions** (4 marks each) with sub parts.
7. **There is no overall choice however an internal choice have been provided in 2 questions in Section -B , 3 questions in Section- C and 2 questions in Section- D**

	Section – A	
	Question Number 1-18 are of MCQ type question of one mark each.	
1.	The domain of the function $\sin^{-1}(4x)$ is : (a) [-4,4] (b) [-2, 2] (c) [-1,1] (d) [-0.25, 0.25]	**1**
2.	If a matrix $A=\begin{bmatrix} 10 & 2k+5 \\ 3k-3 & k+5 \end{bmatrix}$ is symmetric then , the value of k is : (a) 8 (b) 5 (c) -0.4 (d) $\frac{1+\sqrt{1561}}{12}$	**1**
3.	If $A=\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and $A+A^T=I$, then the value of $\tan\alpha$ is: (a) 1 (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 0	**1**

4. For what values of k , the function given below is continuous at x=0? **1**

$$f(x)=\begin{cases} \dfrac{\sqrt{4+x}-2}{x}, & x\neq 0 \\ k, & ,x=0 \end{cases}$$

(a) 0	(b) 1/4
(c) 1	(d) 4

5. If P ,Q, and PQ are matrices of order 3 × 2 , a × b and 3 × 4 respectively then the number of elements of the matrix Q is? **1**

(a) 6	(b) 8
(c) 4	(d) 12

6. The function , f(x)=x|x|, at x=0 is : **1**

(a) Continuous and differentiable	(b) Continuous but not differentiable
(c) Differentiable but not Continuous	(d) Neither differentiable nor Continuous

7. $\int_{-2}^{3} x^2 dx = k\int_{0}^{2} x^2 dx + \int_{2}^{3} x^2 dx$, then value of k is : **1**

(a) 2	(b) 1
(c) 0	(d) $\frac{1}{2}$

8. Derivative of $e^{\sin^2 x}$with respect to cos x is : **1**

(a) $\sin x . e^{\sin^2 x}$	(b) $\cos x . e^{\sin^2 x}$
(c) $-2\cos x . e^{\sin^2 x}$	(d) $-2\sin^2 x \cos x . e^{\sin^2 x}$

9. The value of $\int_{0}^{\frac{\pi}{2}} \left(\sin^{2025} x - \cos^{2025} x\right) dx$ is equal to : **1**

(a) 0	(b) $\frac{\pi}{2}$
(c) $\frac{\pi}{4}$	(d) π

10. The integrating factor of the differential Equation $\left(1-y^2\right)\frac{dy}{dx} + yx = ay \left(-1<y<1\right)$ is : **1**

(a) $\frac{1}{y^2-1}$	(b) $\frac{1}{\sqrt{y^2-1}}$
(c) $\frac{-1}{\sqrt{1-y^2}}$	(d) $\frac{1}{\sqrt{1-y^2}}$

11. The solution of differential equation $\frac{dy}{dx}=\frac{1}{logy}$ is: **1**

(a) logy =x+c	(b) y logy -y=x+c
(c) logy-y=x+c	(d) y logy+=x+c

12. If the diagonal of parallelogram are $\vec{d}_1=3\hat{i}$ and $\vec{d}_2=4\hat{j}$ then its area is given by : **1**

(a) 2 sq unit	(b)3 sq unit
(c) 6 sq unit	(d) 12 sq unit

13. If $\hat{a}$ and $\hat{b}$ be two unit vectors and 'θ'is the angle between them , then $\left|\hat{a}-\hat{b}\right|$: **1**

(a) $\sin\frac{\theta}{2}$	(b)$2\sin\frac{\theta}{2}$
(c) $\cos\frac{\theta}{2}$	(d) $2\cos\frac{\theta}{2}$

15. The maximum value of the object function Z=5x+10y subject to the constraints $x+2y\leq 120, x+y\geq 60, x-2y\geq 0, x\geq 0, y\geq 0\ is$: **1**

(a) 300	(b) 600
(c) 400	(d) 800

16. Two events A and B will be independent , if : **1**

(a) A and B are mutually exclusive	(b)P(A)=P(B)
(c) $P(\bar{A}\bar{B})=[1-P(A)][1-P(B)]$	(d) P(A) +P(B)=1

17. Corner points of the feasible region determined by the system of linear constraints are (0, 10) , (5, 5) ,(15, 15) ,(0, 20) let Z=px+qy where p , q > 0 . Conditions on p and q so that maximum of Z occurs at both the points (15, 15) and (0 ,20) is : **1**

(a) q=3p	(b) p=2q
(c) q=2p	(d) p=q

18. If $x+y\leq 2, x, y\geq 0$,the point at which maximum value of 3x+2y attained , will be : **1**

(a) (0, 2)	(b) (0, 0)
(c) (2, 0)	(d)$\left(\frac{1}{2},\frac{1}{2}\right)$

	ASSERTION-REASON BASED QUESTIONS **Question number 19 and 20 each carry one mark** **In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.** **(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 but R is true.**	
19.	**Assertion(A):Principal value of** $\cos^{-1}\left(\frac{-1}{2}\right)$ **is** $\frac{2\pi}{3}$ **Reason (R) :** Domain of $\cos^{-1}x$ is R	**1**
20.	**Assertion(A) :**Vector equation of a line passing through through the points A(1, 2, 3) ,and B(4, 5, 6)is $\vec{r}=\left(4\hat{i}+5\hat{j}+6\hat{k}\right)+\lambda\left(\hat{i}+\hat{j}+\hat{k}\right)$ **Reason (R) :** Equation of a line passing through a point with position vector $\vec{a}$ and parallel to a vector$\vec{b}$ is ,$\vec{r}=\vec{a}+\lambda\vec{b}$	**1**
	Section B **This section contains 5 Very Short Answer (VSA)-type questions of 2 marks each.**	
21.	Find the value of $\sin^{-1}\left(-\frac{1}{2}\right)+\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)+\cot^{-1}\left(\tan\frac{4\pi}{3}\right)$ OR Find the domain of the function $f(x)=\sin^{-1}\left(x^2-4\right)$. Also find its range.	**2**
22.	Find the value of k , If the function $f(x)=\begin{cases}\frac{\sin 3x}{x}, & if\ x\neq 0\\ k, & if\ x=0\end{cases}$ is continuous at x=0	**2**
23.	If $y\sqrt{1-x^2}+x\sqrt{1-y^2}=1$ then prove that $\frac{dy}{dx}=-\sqrt{\frac{1-y^2}{1-x^2}}$ **OR** Find the differential of $\sin^2 x$w.r.t e^{cosx}	**2**
24.	A point moves along the curve y=x^2 , if its abscissa increases at the rate 2 units/sec. At what rate is distance from origin is increasing when point is at (2,4).	**2**
25.	Find $\int_{-1}^{2}\frac{\|x\|}{x}dx$ **OR** Find $\int\frac{x+1}{x(1-2x)}dx$	**2**

Section C

This section contains 6 Short Answer (SA)-type questions of 3marks each.

26. If siny=x cos (a+y), Then show that $\frac{dy}{dx}=\frac{\cos^2(a+y)}{\cos a}$, also show that $\frac{dy}{dx}=\cos a\,,when\,x=0$ **3**

27. Consider experiment of tossing a coin . If the coin shows head toss again , but if it shows tail , then throw a die. Find the conditional probability of the event 'the die shows a number greater than 4' given that ' there is atleast one tail'. **3**

OR

A discrete random variable X has the probability distribution as given below:

X	0	1	2	3
P(X=x)	q	$4p^2$	p	$0.7-4p^2$

Find the values of p and q for which the mean of X , (E(x)) is largest .

28. Solve $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{cotx}}$ **3**

OR

Solve $\int_{-5}^{5} |x+2|dx$

29. Solve the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx}=y\cos\left(\frac{y}{x}\right)+x$ **3**

OR

Find the particular solution of the differential equation $\frac{dy}{dx}+y\cot x=2x+x^2\cot x$given that y=0 when $x=\frac{\pi}{2}$

30. Find the distance between the lines $\vec{r}=(3\hat{i}+3\hat{j}-5\hat{k})+\lambda(2\hat{i}+3\hat{j}+6\hat{k})$and $\vec{r}=(\hat{i}+2\hat{j}-4\hat{k})+\mu(2\hat{i}+3\hat{j}+6\hat{k})$ **3**

31. $If\ y=x^{sinx}+(sinx)^x, then\, find\, \frac{dy}{dx}$ **3**

SECTION D

This section contains **four Long Answer (LA)-type** questions of 5marks each.

32. Using integration find the area enclosed by the curve $4x^2-9y^2=36$ **5**

33. Let R be a relation defined on the set of natural numbers N as follows: $\{(x,y): x\in N, y\in N, 2x+y=41\}$. Find the domain and range of the relation R . Also verify whether R is reflexive , symmetric and transitive . **5**

OR

Check whether a function $f:R\rightarrow\left[\frac{-1}{2},\frac{1}{2}\right]$defind as $f(x)=\frac{x}{1+x^2}$is one one and onto or or not.

34. Find the image of the point (1, 2, 3) in the line $\vec{r}=6\hat{i}+7\hat{j}+7\hat{k}+\lambda(3\hat{i}+2\hat{j}-2\hat{k})$ **5**

OR

Find the shortest distance between the lines given by $\vec{r}=(1-t)\hat{i}+(t-2)\hat{j}+(3-2t)\hat{k}$ and

$\vec{r}=(s+1)\hat{i}+(2s-1)\hat{j}-(2s+1)\hat{k}$

35. **5**

Solve the following Linear Programming Problem graphically :

Maximize Z=100x +300y subject to constraints

$x+2y\leq 12$

$2x+y\leq 12$

$4x + 5y \geq 20$
$x \geq 0, y \geq 0$

Section E

Source based/Case based/passage based/integrated units of assessment Questions

36. Utkarsh , Kavyansh and Myiesha appeared for an interview for three vacancies in the same post . The probability of Utkarsh selection is 1/5. Kavyansh selection is 1/3 and Myiesha's selection is 1/4. The event of selection is independent of each other . **1+1+2**

Based on the above information answer the following questions :
(i)What is the probability that atleast one of them is selected?
(ii)Find $P\left(\frac{G}{\bar{H}}\right)$ where G is the event of Kavyansh selection and $\bar{H}$ denotes the event that Utkarsh is not selected.
(iii)Find the probability that atleast one of them is selected.

OR

(III)Find the probability that exactly two of them are selected.

37. **1+1+2**

Overspeeding 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(l/100km) and speed V(km/h) under some constraints is given as $F = \frac{V^2}{500} - \frac{V}{4} + 14.$
On the basis of the above information answer the following questions:
(i) Find F, when V=40km/h.
(ii) Find $\frac{dF}{dV}$.
(iii) Find the speed V for which fuel consumption F is minimum.

OR

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

38.	Three shopkeepers A, B and C go to a store to buy stationary. A purchase 12 dozen notebooks, 5 dozen pens and 6 dozen pencils. B purchase 10 dozen notebooks, 6 dozen pens and 7 dozen pencils. C purchase 11 dozen notebooks, 13 dozen pens and 8 dozen pencils. A notebook costs ₹ 0, a pen costs ₹ 12 and a pencil costs ₹ 3.  i) Represent the number of items purchased by shopkeepers A, B and C in matrix form. ii) If Y represents the matrix formed by the cost of each item, then find XY.	**2+2**