# Directorate of Education, GNCT of Delhi

**Practice Paper -II**

**(2023-24)**

**Class – XII**

**Mathematics (Code: 041)**

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

## General Instructions :

1. This Question paper contains - **five sections A,B,C,D,E**. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has 18 **MCQ's and 02** Assertion-Reason based questions of 1 mark each.(20 Marks )
3. **Section B**has 5 **Very Short Answer (VSA)-type** questions of 2 marks each.(10 Marks )
4. **Section C** has 6 **Short Answer (SA)-type** questions of 3 marks each.(18 Marks )
5. **Section D** has 4 **Long Answer (LA)-type** questions of 5 marks each.(20 Marks )
6. **Section E has 3 Source based/Case based/passage based/integrated units of assessment (4 marks each) with sub parts.(12 Marks )**

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|---|---|---|
| | **Section – A** | |
| | Question Number 1-18 are of MCQ type question one mark each. | |
| **1.** | The domain of the function $\cos^{-1}(2x-3)$ is :<br>(a) [-1,1] (b ) (1, 2)<br>(c) (-1,1) (d) [1 ,2] | **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 :<br>(a) 8 (b ) 5<br>(c) -0.4 (d) $\frac{1+\sqrt{1561}}{12}$ | |
| **3.** | For two matrices $P=\begin{bmatrix} 3 & 4 \\ -1 & 2 \\ 0 & 1 \end{bmatrix}$ and $Q^T=\begin{bmatrix} -1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, P-Q is:<br>(a) $\begin{bmatrix} 2 & 3 \\ -3 & 0 \\ 0 & -3 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & 3 \\ -3 & 0 \\ -1 & -2 \end{bmatrix}$<br>(c) $\begin{bmatrix} 4 & 3 \\ -0 & -3 \\ -1 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & 3 \\ 0 & -3 \\ 0 & -3 \end{bmatrix}$ | |

| | | |
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| **4.** | If A is a matrix of order 3x3 and $\|A\|=5$, then adj A is : | |
| | (a) 250 / (b) 125 / (c) 625 / (d) 25 | |

| | |
|---|---|
| (a) 250 | (b) 125 |
| (c) 625 | (d) 25 |

| | | |
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| **5.** | Suppose P and Q are two different matrices of order 3 × n and n × p , then the order of the matrix P × Q is? | **1:** |

| | |
|---|---|
| (a) 3 x p | (b ) p x 3 |
| (c) n x n | (d) 3 x 3 |

| | | |
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| 6. | Which of the following point lies in the half plane x+y-6 = 0 ? | |

| | |
|---|---|
| (a) (5 ,2) | (b ) (2 ,5) |
| (c) (8 ,1) | (d) (1,3) |

| | | |
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| 7. | Which of the following differential equations have same order and degree? | |

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|---|---|
| (a) $y'+y''=0$ | (b ) $(y'')+(y')^2=0$ |
| (c) $(y'')^2+(y')^2+x=0$ | (d) $y''=2y$ |

| | | |
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| **8.** | If x=log 5t and y=log 7t , then $\frac{dy}{dx}$ is : | **1** |

| | |
|---|---|
| (a) 1 | (b) 2 |
| (c) $\frac{7}{5}$ | (d) $\frac{5}{7}$ |

| | | |
|---|---|---|
| **9.** | The value of $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (x\cos x+x^3+1-\tan^5 x)dx$ is equal to : | **1** |

| | |
|---|---|
| (a) $\pi$ | (b) $2\pi$ |
| (c) $3\pi$ | (d) $4\pi$ |

| | | |
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| **10.** | The integrating factor of the differential Equation $(1-y^2)\frac{dy}{dx}+yx=ay(-1<y<1)$ 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.** | Product of order and degree of differential equation $\sqrt{1+\frac{d^2y}{dx^2}}=x\frac{dy}{dx}$<br>(a) 3 \| (b )2<br>(c) 4 \| (d) 1 | |
| **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 :<br>(a) 2 sq unit \| (b )3 sq unit<br>(c) 6 sq unit \| (d) 12 sq unit | |
| **13.** | If $\hat{a}$ and $\hat{b}$ be two unit vectors and $'\theta'$ is the angle between them , then $\|\hat{a}-\hat{b}\|$ :<br>(a) $\sin\frac{\theta}{2}$ \| (b ) $2\sin\frac{\theta}{2}$<br>(c) $\cos\frac{\theta}{2}$ \| (d) $2\cos\frac{\theta}{2}$ | **1** |
| **15.** | The maximum value of the object function Z=5x+10y subject to the constraints $x+2y\leq120, x+y\geq60, x-2y\geq0, x\geq0, y\geq0$ *is* :<br>(a) 300 \| (b ) 600<br>(c) 400 \| (d) 800 | **1** |
| **16.** | If A and B are two independent events with $P(A)=\frac{3}{5}$ and $P(B)=\frac{4}{9}$ ,then $P(A'\cap B')$ equals :<br>(a) $\frac{4}{15}$ \| (b) $\frac{8}{15}$<br>(c) $\frac{1}{3}$ \| (d) $\frac{2}{9}$ | **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 :<br>(a) q=3p \| (b ) p=2q<br>(c) q=2p \| (d) p=q | |
| **18.** | If $x+y\leq2$, $x, y\geq0$, the point at which maximum value of 3x+2y attained , will be :<br>(a) (0, 2) \| (b ) (0, 0)<br>(c) (2, 0) \| (d) $\left(\frac{1}{2},\frac{1}{2}\right)$ | **1** |

**(ASSERTION-REASON BASED QUESTIONS )**

**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** $\cos^{-1}(\frac{-1}{2})$ **is** $\frac{2\pi}{3}$ — **1**

**Reason ( R) :**Domain of $\cos^{-1}x$ is R

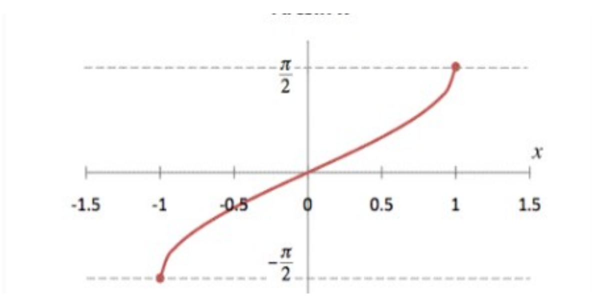
**20.** **Assertion( A) :**Vector equation of a line passing through through the points A(1, 2, 3) ,and B(4, 5, 6)is $\vec{r}=(4\hat{i}+5\hat{j}+6\hat{k})+\lambda(\hat{i}+\hat{j}+\hat{k})$

**Reason ( R) :** Equation of a line passing through a point with position vector $\vec{a}$ and parallel to a vector $\vec{b}$ is , $\vec{r}=\vec{a}+\lambda\vec{b}$

## ( Section B)

**This section contains 5 Very Short Answer (VSA)-type questions of 2 marks each.**

**21.** The graph of an inverse trigonometric function f(x) is given below, observe the graph and answer the following questions — **2**




(i) If $f(x)=\frac{\pi}{6}$ , then find the value of x

(ii) What is the value of $f(\frac{-1}{\sqrt{2}})$ ?

**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 $\frac{dy}{dx}=-\sqrt{\frac{1-y^2}{1-x^2}}$ — **2**

**OR**

Find the differential of $\sin^2 x$ w.r.t $e^{cosx}$

**24.** A point moves along the curve y=x² , 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 $\int_{-1}^{2}\frac{|x|}{x}dx$ — **2**

OR

Find

$$\int\frac{x+1}{x(1-2x)}dx$$

| | | |
|---|---|---|
| | **Section C**<br>**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'.<br>**OR**<br>A random variable X has the probability distribution as given below:<br>X: 0, 1, 2, 3<br>P(x): $k$, $k^2$, $2k^2$, $k$<br>Find the value of k , hence determine the mean of the distribution. | 3 |
| **28.** | Solve $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{cotx}}$<br>**OR**<br>Solve $\int_{-5}^{5} \|x+2\|dx$ | 3 |
| **29.** | Solve the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx}=y\cos\left(\frac{y}{x}\right)+x$<br>**OR**<br>Find the particular solution of the differential equation $\frac{dy}{dx}+y\cot x=2x+x^2\cot x$ given that y=0 when $x=\frac{\pi}{2}$ | 3 |
| **30.** | Maximize : Z=x+2y<br>Subject to constraints :<br>$x+2y\geq 100, 2x-y\leq 0, 2x+y\leq 0, x\geq 0, y\geq 0$<br>Solve the LPP graphically. | 3 |
| **31.** | $If\ y=x^{sinx}+(sinx)^x, then\ find\ \frac{dy}{dx}$ | 3 |
| | **<u>(SECTION D )</u>**<br>This section contains **four Long Answer (LA)-type** questions of 5marks each. | |
| **32.** | Find the area of the region bounded by the lines y=3x+2, the x axis , and the ordinates x=-1 and x=1 | 5 |
| **33.** | Let R be a relation defined on the set of natural numbers N as follows:<br>{ $(x,y): x\in N, y\in N, 2x+y=41$ **}** . Find the domain and range of the relation R . Also verify whether R is reflexive , symmetric and transitive . | 5 |
| **34.** | Find the image of the point (1, 2, 3) in the line<br>$\vec{r}=6\hat{i}+7\hat{j}+7\hat{k}+\lambda(3\hat{i}+2\hat{j}-2\hat{k})$<br>**OR**<br>Find the shortest distance between the lines given by $\vec{r}=(1-t)\hat{i}+(t-2)\hat{j}+(3-2t)\hat{k}$ and<br>$\vec{r}=(s+1)\hat{i}+(2s-1)\hat{j}-(2s+1)\hat{k}$ | 5 |
| **35.** | | |

If $A=\begin{bmatrix}1 & 3 & 2\\ 2 & 0 & -1\\ 1 & 2 & 3\end{bmatrix}$, then show that $A^3-4A^2-3A+11I=0$, hence find $A^{-1}$.

**OR**

If A= $\begin{bmatrix}1 & 2 & 0\\ -2 & -1 & -2\\ 0 & -1 & 1\end{bmatrix}$, then find the value of $A^{-1}$.

using $A^{-1}$ ,solve the system of linear equations x-2y=10 , 2x-y-z=8 and -2y+z=7

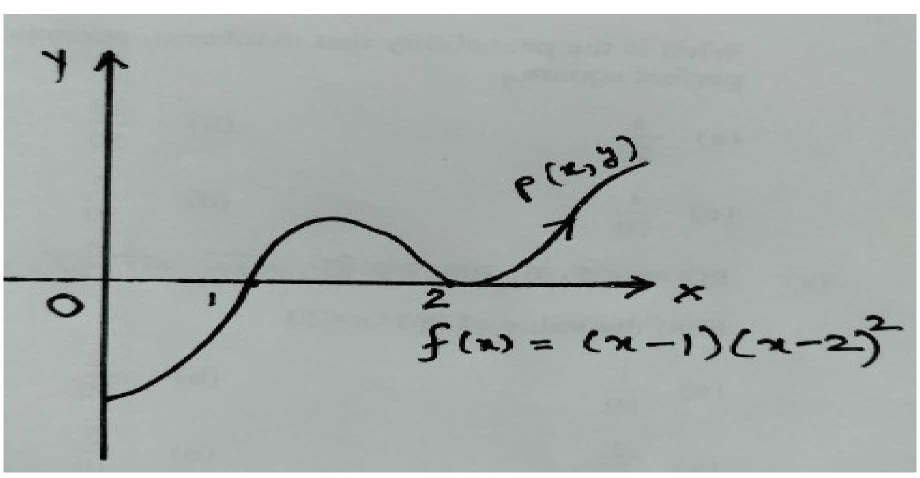
## (Section E)

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

**36.** In a group activity class there are 10 students whose ages are 16,17, 15,14, 19,17, 16,18, 16 and 15 years. One student is selected at random such that each has equal chance of being choosen and age of student is recorded . On the basis on information given above answer the following questions.

(i) Find the probability that age of a selected student is a composite number .
(ii) Let x be the age of selected student . What can be the value of x?
(iii)Find the probability distribution of random variable x and hence find the mean age.
OR
(iii) If a student of age 14 years is replaced by another student of age 18 years , then find the probability distribution of random variable x and hence find the mean age.

**37.** A particle is moving along the curve represented by the polynomial $f(x)=(x-1)(x-2)^2$ as shown in the figure given below. **1+1++2**



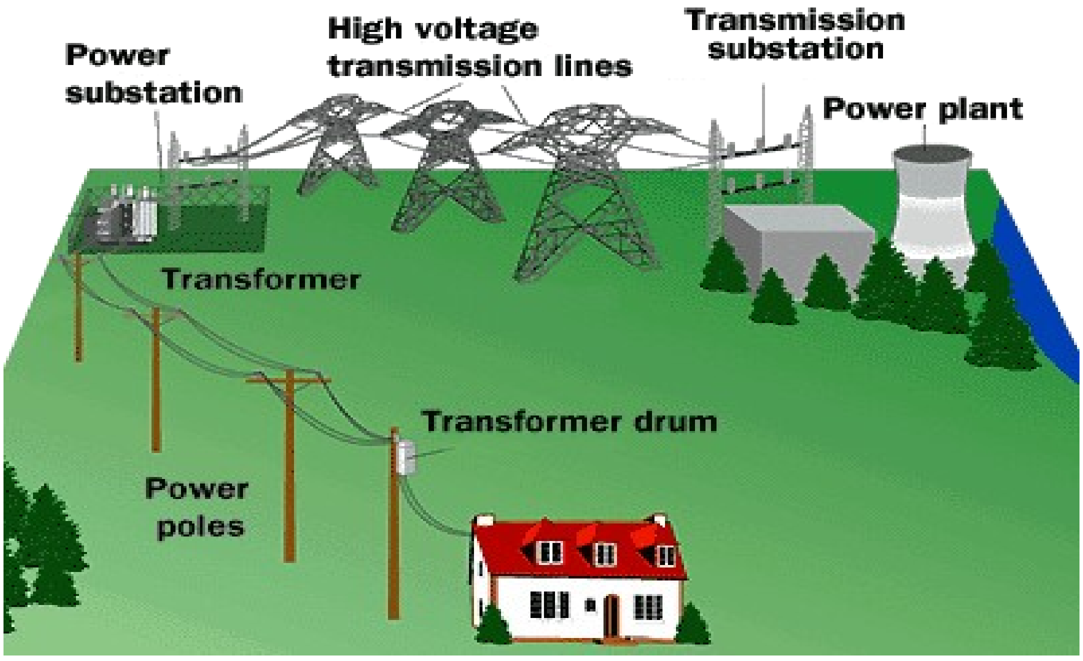

Based on the above information answer the following questions.
(i)Find Critical points of polynomial $f(x)=(x-1)(x-2)^2$ .
(ii)Find the interval where f(x) is strictly increasing
(iii)Find the interval where f(x) is strictly decreasing.
OR
What is the point of local maxima of $f(x)=(x-1)(x-2)^2$ ?

**38.** Repair and maintenance of lines is very important for uninterrupted supply of electricity.

Maintenance is done primarily twice a year, once before monsoon and the next is done after monsoon to see if any breakdown has occurred in the line. Electrical transmission wires which are laid down in winters are stretched tightly to accomodate expnsion in summers . Two such wires lie along the following lines :

$$l_1 : \frac{x+1}{3} = \frac{y-3}{2} = \frac{z+2}{-1}$$

$$l_2 : \frac{x}{-1} = \frac{y-7}{3} = \frac{z+7}{-2}$$




Based on the information given above answer the following questions :

(i) Are the lines $l_1$ and $l_2$ coplanar (distance is zero)? Justify your answer.

(ii) Find the point of intersection of the lines $l_1$ and $l_2$ .