D.A.V. INSTITUTIONS, CHHATTISGARH

PRACTICE PAPER-2 : 2023-24

CLASS – XII

SUBJECT- MATHEMATICS (041)

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

General Instructions:

1. **All questions are compulsory.**
2. **The question paper has five sections. Section–A, Section-B, Section-C, Section-D and Section–E. There are 38 questions in the question paper.**
3. **Section–A has 18 MCQ questions and 2 Assertion- Reason based question of 1 marks each. Section–B has 5 Very Short Answer (VSA) type questions of 2 marks each, Section-C has 6 Short Answer (SA) type questions of 3 marks each, Section–D has 4 Long Answer (LA) type questions of 5 marks each and Section–E has 3 case based questions of 4 marks each.**
4. **There is no overall choice. However internal choice have been provided in some questions. Attempt only one of the alternatives in such questions.**
5. **Wherever necessary, neat and properly labelled diagram should be drawn.**

Section-A

(Select the correct options. Each MCQ carries 1 mark)

1.If A is a square matrix of order 3,such that A(adj A)=10I, |adj A| is equal to

a)1 b)10 c)100 d)101

2.If A=$\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$,then A^{-1} is equal to

a)$\begin{bmatrix}-1 & 4\\ -1 & 3\end{bmatrix}$ b)$\begin{bmatrix}1 & 4\\ -1 & 3\end{bmatrix}$ c)$\begin{bmatrix}1 & -4\\ 1 & -3\end{bmatrix}$ d)$\begin{bmatrix}1 & 4\\ 3 & -1\end{bmatrix}$

3.The function $f(x)=\begin{cases}\frac{k\cos x}{\pi-2x}, & x\neq\frac{\pi}{2}\\ 3, & x=\frac{\pi}{2}\end{cases}$ is continuous at x=$\frac{\pi}{2}$,when k equals

a)-6 b)6 c)5 d)-5

4.For what value of k ,the matrix $\begin{bmatrix}2-k & 4\\ -5 & 1\end{bmatrix}$ is not invertible?

a)8 b)17 c)22 d)25

5.If A=$\begin{bmatrix}2 & 3\\ -4 & -6\end{bmatrix}$,then which of the following is true?

a)A(adj A)≠|A|I b)A(adj A)≠(adj A)A

c)A(adj A)=(adj A)A=|A|I=$\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$ d)None of these

6.The value of x if $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$,is

a)±√3 b)2 c)±3 d)±√2

7.The graph of the inequality 2x+3y>6 is

a)half plane that contains the origin

b)half plane that neither contains the origin nor the points of the line 2x+3y=6

c)whole XOY-plane excluding the points on the line 2x+3y=6

d)entire XOY-Plane

8.In an LPP,if the objective function has Z=ax+by has the same maximum value on two corner points of the feasible region,then the number of points at which Zmax occurs is

a)0 b)2 c)finite d)infinite

9.The integrating factor of the differential equation $x\frac{dy}{dx}+2y=x^2$ is

a)x b)x^2 c)3x d)xy

10.The projection of the vector $\hat{\imath}+3\hat{\jmath}+7\hat{k}$ on the vector $2\hat{\imath}-3\hat{\jmath}+6\hat{k}$ is

a)4 b)5 c)1 d)0

11.The lines $\frac{x-2}{1}=\frac{y-3}{1}=\frac{4-z}{k}$ and $\frac{x-1}{k}=\frac{y-4}{2}=\frac{z-5}{-2}$ are mutually perpendicular,if the value of k is

a)$\frac{-2}{3}$ b)$\frac{2}{3}$ c)-2 d)2

12.If P(A)=$\frac{1}{2}$,P(B)=0,then P($\frac{A}{B}$) is

a)0 b)$\frac{1}{2}$ c)∞ d)1

13.The sum of order and degree of the differential equation $(\frac{dy}{dx})^4+3y(\frac{d^2y}{dx^2})=0$ is

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

14.Which of the following is not a homogeneous function of x and y?

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

15.If $(\hat{\imath}+3\hat{\jmath}+9\hat{k})\times(3\hat{\imath}-\lambda\hat{\jmath}+\mu\hat{k})=0$,then λ+μ is equal to

a)10 b)18 c)0 d)1

16.$\int_0^{2\pi} |\sin x|\, dx$ is equal to

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

17.The area of a parallelogram whose adjacent sides are represented by the vectors (2 $\hat{\imath}$-3$\hat{k}$) and (4$\hat{\jmath}$+2$\hat{k}$) is (in sq units)

a)√14 b)3√14 c)4√14 d)2√15

18.The angle between the unit vectors $\hat{a}$ and $\hat{b}$,given that $|\hat{a}+\hat{b}|$=1,is

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

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 and 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):If R is the relation in set {1,2,3,4,5,6} and R={(a,b):b=a+1},then R is reflexive.

Reason(R):The relation R in the set {1,2,3} given by R={(1,2),(2,1)} is symmetric.

20.Assertion(A):We can write $\sin^{-1} x=(\sin x)^{-1}$

Reason(R):Any value in the range of principal value branch is called principal value of that inverse trigonometric function.

Section-B

(Each question carries 2 marks)

21.Find the domain of $\cos^{-1}(2x-1)$

OR

Evaluate: $\text{Sin}^{-1}(\sin \frac{2\pi}{3})$

22.Show that f(x) =log sinx is strictly decreasing on ($\frac{\pi}{2}$,π).

23.Find the stationary point of the function $f(x)=x^x$.

OR

Find two positive numbers whose sum is 16 and the sum of whose square is minimum.

24.Evaluate $\int_0^{\pi/2} cos^2\, x\, dx$

25.Find the interval in which the function is increasing or decreasing where f(x)=$\frac{x}{\log x}$.

Section-C
(Each question carries 3 marks)

26.Evaluate $\int \frac{x^2-1}{x^4+x^2+1}$dx

27.The random variable X has a probability distribution P(X) of the following form,where k is some real number:

$$P(X)=\begin{cases} k, if\ x=0 \\ 2k\ , if\ x=1 \\ 3k, if\ x=2 \\ 0, otherwise \end{cases}$$

(i)Determine the value of k
(ii)Find P(X<2)
(iii)Find P(X.2)

28.Evaluate $\int x\ sin^{-1}$x dx

OR

Evaluate $\int\sqrt{(1-\sin 2x)}$dx

29.Find the particular solution of the differential equation e^xtan y dx + (2-e^x)sec^2y dy=0, given that y=$\frac{\pi}{4}$ when x=0.

OR

Find the general solution of the following differential equation

x cos($\frac{y}{x}$) $\frac{dy}{dx}$ = y cos($\frac{y}{x}$) + x , x≠0

30.Solve the following LPP graphically:

Maximize Z=20x+10y
Subject to the constraints: x+2y≤28
3x+y ≤ 24
x ≥ 2
x≥0,y≥0

OR

Solve the following LPP graphically:
Minimize Z=6x+3y
Subject to the constraints: 4x+y≥80
x+5y ≥115
3x+2y≤150
x≥0,y≥0

31.If $x^m y^n=(x+y)^{m+n}$,then prove that $\frac{d^2y}{dx^2}$=0.

Section-D

(Each question carries 5 marks)

32.If N denotes the set of all natural numbers and R is the relation on NxN defined by (a,b) R (c,d) if ad(b+c)=bc(a+d).Show that R is an equivalence relation.

OR

Show that the function f:R→R defined by f(x)=$\frac{x}{x^2+1}$,for all x ϵ R is neither one-one nor onto.

33.Find the area bounded by the curve x=4-y^2 and the y-axis.

34.Using matrix method ,solve the following system of linear equations:

$\frac{2}{x}-\frac{3}{y}+\frac{3}{z}=10$

$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=10$

$\frac{3}{x}-\frac{1}{y}+\frac{2}{z}=13$

35.Find the shortest distance between the lines

$\vec{r}=(t+1)\,\hat{\imath}$+(2-t)$\hat{\jmath}$+(1+t)3$\hat{k}$ and $\vec{r}=(2s+2)\,\hat{\imath}$-(1-s)$\hat{\jmath}$+(2s-1)3$\hat{k}$

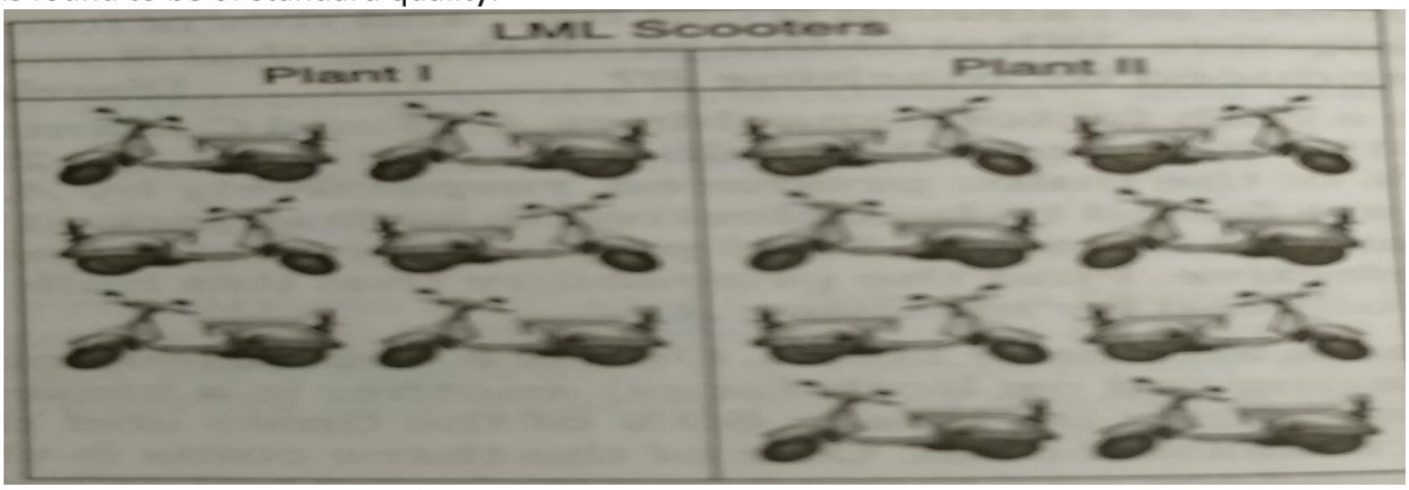
OR

Find a vector of magnitude 3,which is perpendicular to both the vectors 3$\hat{\imath}$+$\hat{\jmath}$-4$\hat{k}$ and 6$\hat{\imath}$+5$\hat{\jmath}$-2$\hat{k}$.

Section-E

(This section comprises of 3 case-study/passage based question of 4 marks each with sub parts. The first two case study questions have three parts (i),(ii),(iii) of marks 1,1,2 respectively.The third case study question has two sub parts of 2 marks each.)

36.A LMLscooter company has two plants to manufacture.Plant I manufactures 70% of scooters and Plant II manufactures 30% .At Plant I,80% scooters are rated as of standard quality and at Plant II,90% of the scooters are rated as of standard quality.A scooter is choosen at random and is found to be of standard quality.



[5]

(i)Find the probability that the chosen scooter is not of standard quality,which is not manufacturing in plant II.

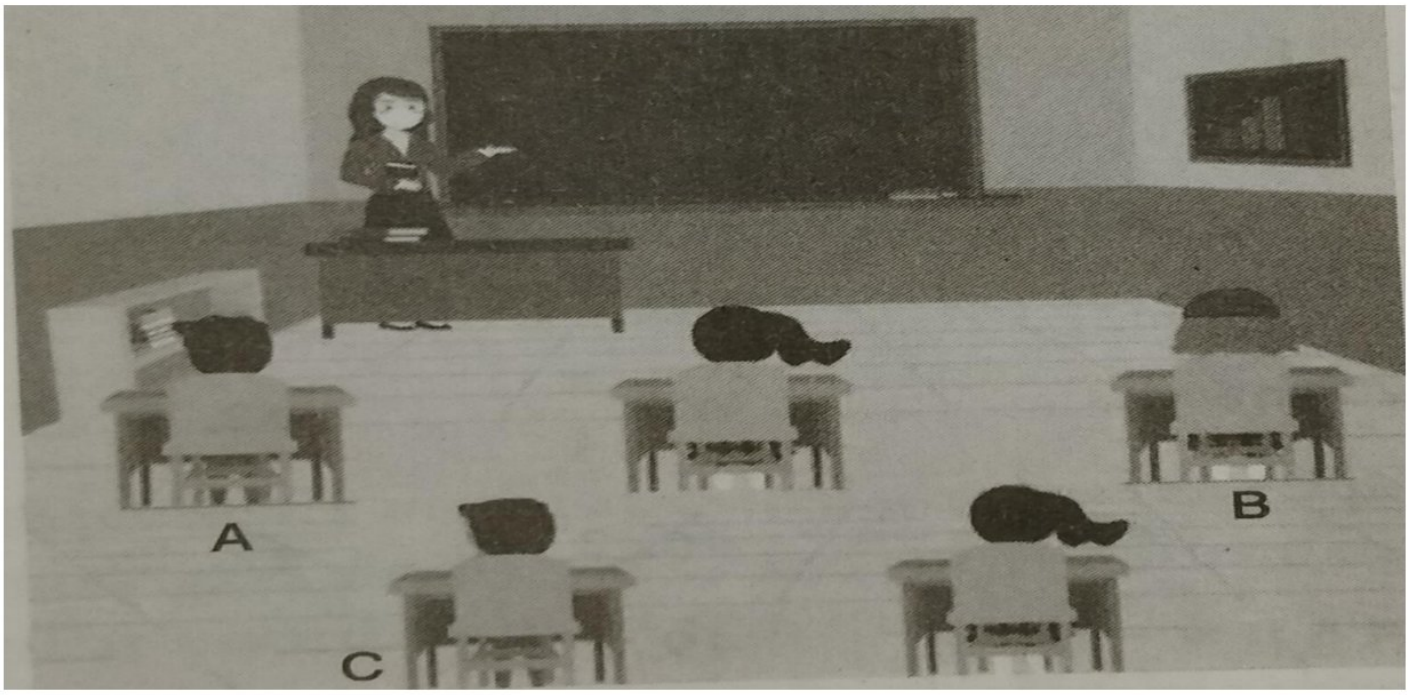
(ii)Find the probability that the chosen scooter is manufacturing either of any plant.

(iii)Find the probability that the chosen scooter is not manufacturing by any of the plant.

OR

(iv)Find the probability that the chosen scooter is of standard quality.

37.In unlock period ,the students are sitting in the classroom with some spaces,as per the guidelines of central board of secondary education.The position of three special students Sumit,Harish and Anil in the class are respectively,A(2,1,-1)B(1,0,-3) and C(-1,2,1).



Based on the given information,answer the following questions.

(i)Find the distance between Sumit and Harish.

(ii)If we want to insert one student between Sumit and Harish such that student is 2 units distance form Sumit and 1 unit distance from Harish and all three are in a line.Then,find the position of the inserted student.

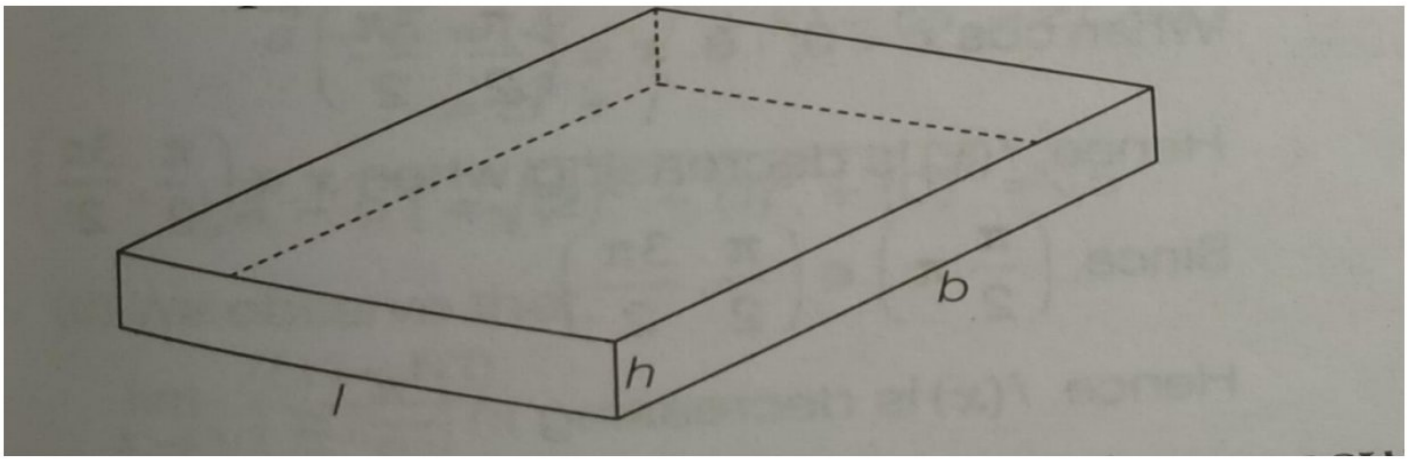
(iii)Find the area of the region coverted by these three postions.

OR

(iv)Find a unit vector,which is perpendicular to the vectors A,B and C.

[6]

38.A square piece of tin of side 24 cm is to be made into a box without top by cutting a square from each corner and folding up the flaps to form a box.



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

(i)Write the length,breadth and height of the box formed in terms of x.

(ii)Show that volume of the box is maximum,when x=4 cm.

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[7]