

SET NO – 01

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Candidates must write the Set No. on the title page of the answer book.

DAV PUBLIC SCHOOLS POKHARIPUT, BHUBANESWAR-21

PSVT- 2021-22

- Check that this question paper contains 4 printed pages.
- Set number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Check that this question paper contains 17 questions.
- Write down the Serial Number of the question in the left side of the margin before attempting it.

CLASS- XII

SUB : MATHEMATICS

Time : $1\frac{1}{2}$ Hours

Maximum Marks : 40

General Instructions :

1. This question paper contains two parts A and B. Each part is compulsory. Part A carries 9 marks and part B carries 31 marks.
2. Part A has objective type questions and Part B has descriptive type questions.
3. Both Part A and B have choices.

Part-A

1. It consists of two sections I and II.
2. Section I comprises of five short answers type questions.
3. Section II comprises of one case study. Each case study comprises of 5 case based MCQs. An examinee is to attempt any 4 out of 5 MCQs.

Part-B

1. It consists of two sections III ,IV and V.

2. Section –III comprises of 5 questions of 2 marks each.
3. Section –IV comprises of 3 questions of 3 marks each.
4. Section –V comprises of 2 questions of 5 marks each
5. Internal choice is provided in 2 questions of section-III, 3 questions of Section-IV,2 questions of Section-V .You have to attempt only one of the alternatives in all such questions.

Part –A

Section-I

All questions are compulsory. In case of internal choices, attempt any one

1. What is the domain of the function $\sin^{-1}x$
2. Write the value of $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$.

OR

If $\sin\left(\sin^{-1}\frac{1}{5} + \cos^{-1}x\right) = 1$, then find the value of x .

3. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = (3 - x^3)^{1/3}$ then find $f[f(x)]$.

OR

Write fog , if $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ are given by $f(x) = 8x^3$ and $g(x) = x^{\frac{1}{3}}$.

4. Let R be the equivalence relation in the set $A = \{0,1,2,3,4,5\}$ given by $R = \{(a, b) : 2 \text{ divides } a-b\}$. Write the equivalence class $[0]$.
5. Justify linear function is bijective.

Section-II

6. Two schools P and Q decided to award their selected students for the values of discipline and honesty in the form of prizes at the rate of Rs x and Rs y respectively. School P decided to award respectively 3,2 students a total prize money of Rs2300 and school Q decided to award respectively 5,3 students a total prize money of Rs3700.

Based on the above information answer the following questions :

- I. The matrix equation representing the above situation is

$$\begin{array}{ll} \text{A) } \begin{bmatrix} 3 & 2 \\ 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2300 \\ 3700 \end{bmatrix} & \text{C) } \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2300 \\ 3700 \end{bmatrix} \\ \text{B) } \begin{bmatrix} 3 & 2 \\ 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3700 \\ 2300 \end{bmatrix} & \text{D) } \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix} \begin{bmatrix} 2300 \\ 3700 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} \end{array}$$

II. The value of the determinant of Coefficient matrix is

- A) 9 B)10 C)-1 D)1

III. If A is the matrix representing the coefficients of x and y ,then adjA is

- A) $\begin{bmatrix} 3 & -2 \\ 5 & 3 \end{bmatrix}$ B) $\begin{bmatrix} 3 & -2 \\ 5 & -3 \end{bmatrix}$ C) $\begin{bmatrix} 3 & 2 \\ -5 & 3 \end{bmatrix}$ D) $\begin{bmatrix} 3 & -2 \\ -5 & 3 \end{bmatrix}$

IV. The inverse of matrix a is

- A. $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ B) $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ C) $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ D) $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$

V. Using matrix method ,The value of x and y is

- A) 400,500 B) 500, 400 C) 600,300 D) None

Part-B

Section-III

7. If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ then show that $A^2 - 4A + 7I = 0$

OR

Show that all the diagonal elements of a skew-symmetric matrix are zero.

8. Prove that $3\sin^{-1}x = \sin^{-1}(3x - 4x^3)$, $x \in \left(-\frac{1}{2}, \frac{1}{2}\right)$.

OR

Prove that $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$.

9. Show that the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \frac{x}{x^2+1}$ is not one-one.

10.If $f, g : \mathbb{R} \rightarrow \mathbb{R}$ are two functions defined as $f(x) = |x| + x$ and $g(x) = |x| - x \forall x \in \mathbb{R}$ then find fog

11.Solve $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}x ; x > 0$

12.If Z is the set of all integers and R is the relation on Z defined as $R = \{(a,b) : a,b \in Z \text{ and } a - b \text{ is divisible by } 5\}$. Prove that R is both reflexive and symmetric.

Section-IV

13.Prove that $\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}] = \sqrt{\frac{1+x^2}{2+x^2}}$

OR

Prove that $\cot^{-1}7 + \cot^{-1}8 + \cot^{-1}18 = \cot^{-1}3$.

14.Show that $f:\mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = \begin{cases} x + 1 & x \text{ is odd} \\ x - 1 & x \text{ is even} \end{cases}$ is both one-one and onto

OR

If $f: [0, \infty) \rightarrow [-5, \infty)$ given by $f(x) = 9x^2 + 6x - 5$. Show that f is

Invertible with $f^{-1}(y) = \frac{\sqrt{y+6}-1}{3}$.

15. Using properties prove that
$$\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc.$$

OR

For the following matrices A and B , verify that $[AB]^T = B^T A^T$;

$$A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}, B = \begin{bmatrix} -1 & 2 & 1 \end{bmatrix}.$$

Section-V

All questions are compulsory. In case of internal choices attempt any one.

16. Using matrix method, solve the following system of equations

$$3x-2y+3z=8 \quad 2x+y-z=1 \quad 4x-3y+2z=4$$

OR

If $A = \begin{bmatrix} 3 & 1 & 2 \\ 3 & 2 & -3 \\ 2 & 0 & -1 \end{bmatrix}$ then find A^{-1} . Hence solve the system of following equations

$$3x+3y+2z=1 \quad x+2y=4 \quad \text{and} \quad 2x-3y-z=5$$

17. If a, b, c are all non-zero and
$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0,$$
 then

Prove that $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + 1 = 0$.

OR

Using properties of the determinants, Show that

$$\begin{vmatrix} (x+y)^2 & zx & zy \\ zx & (z+y)^2 & xy \\ zy & xy & (z+x)^2 \end{vmatrix} = 2xyz(x+y+z)^2$$

Sl No	Name of the Chapter	1 marks	2 marks	3marks	5marks	Sub total
1	Relation and function	3	2	1	10
2	Inverse trigonometry function	2	2	1	9
3	Matrix and determinant	4	1+1	1	2	21
	Total	9	12	9	10	40