SAMPLE PAPER – I

General Instructions:

1. **All questions are compulsory**
2. **This question paper consists of 26 questions divided into three sections A, B and C. Section A comprises of 6 questions of one mark each, section B comprises of 13 questions of four marks each and section C comprises of 7 questions of six marks each**
3. **All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question**
4. **There is no overall choice. However, internal choice has been provided in 04 questions of four marks each and 02 questions of six marks each. You have to attempt only one of the alternatives in all such questions.**
5. **Use of calculators is not permitted. You may ask for logarithmic tables, if required**

SECTION - A (1 mark questions)

1. If A =[a_{ij}] where $a_{ij} = \begin{cases} i+j & if\ \ i \geq j \\ i-j & if\ \ i < j \end{cases}$, then construct a 2×3 matrix A

2. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then find the value of x

3. If $X_{m\times 3} . Y_{p\times 4} = Z_{2\times b}$ for three matrices X,Y and Z then find the values of m,p and b

4. If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} + 4\hat{j} + 9\hat{k}$ find a unit vector parallel to $\vec{a} + \vec{b}$

5. Find the distance of the point (2,3,4) from the plane $\vec{r} . (3\hat{i} - 6\hat{j} + 2\hat{k}) = -11$

6. Find the angle between the line $\frac{x+2}{4} = \frac{y-1}{-5} = \frac{z}{7}$ and the plane 3x-2z + 4 = 0

SECTION - B (4 marks questions)

7. For the curve y = $4x^3 - 2x^5$, find all the points at which tangent passes through the origin.

OR

Sand is pouring from a pipe at the rate of 12 cm^3/s. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm?

8. Show that the points A, B and C with position vectors, $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$, respectively form the vertices of a right angled triangle.

9. Prove that if a plane has the intercepts *a*, *b*, *c* and is at a distance of *p* units from the origin, then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}$

OR

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

10. Find the probability distribution of number of doublets in three throws of a pair of dice.

11. Write the simplest form of $\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$

OR

Prove that $\sin^{-1}\frac{3}{5}-\sin^{-1}\frac{8}{17}=\cos^{-1}\frac{84}{85}$

12. Discuss the continuity of the function f defined by $f(x)=\begin{cases} x+2 & if \quad x\geq 1 \\ x-2 & if \quad x<1 \end{cases}$

13. Evaluate $\int_2^5 \frac{\sqrt{x}}{\sqrt{7-x}+\sqrt{x}}dx$

14. If y = $\tan^{-1}\left(\frac{5ax}{a^2-6x^2}\right)$ then show that $\frac{dy}{dx}=\frac{3a}{a^2+9x^2}+\frac{2a}{a^2+4x^2}$

15. Form the differential equation of the family of circles having centre on *y*-axis and radius 3 units.

16. Show that the relation R in the set R of real numbers, defined as R = {(*a*, *b*) : $a\leq b^2$} is neither reflexive nor symmetric nor transitive.

17. Evaluate $\int e^x \frac{(x^2+1)}{(x+1)^2}dx$

OR Evaluate $\int \frac{(x^4-x)^{\frac{1}{4}}}{x^5}dx$

18. Evaluate $\int_{-1}^{2}(7x-5)dx$ as a limit of sums

19. Show that $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}=0$ where a, b, c are in Arithmetic Progression

20. If length of three sides of a trapezium other than base is equal to 10cm each, then find the area of the trapezium when it is maximum.

OR

Prove that the radius of the right circular cylinder of greatest curved surface area which can be inscribed in a given cone is half of that of the cone.

21. Using integration find the area of region bounded by the triangle whose vertices are (– 1, 0), (1, 3) and (3, 2).

22. Find the equation of the plane passing through the point (−1, 3, 2) and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$.

23. Solve the differential equation

$$\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$$

24. A merchant plans to sell two types of personal computers – a desktop model and a portable model that will cost Rs 25000 and Rs 40000 respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine the number of units of each type of computers which the merchant should stock to get maximum profit if he does not want to invest more than Rs 70 lakhs and if his profit on the desktop model is Rs 4500 and on portable model is Rs 5000.

25. Given two matrices A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B= $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ verify that BA=6I.Use the result to solve the system x-y = 3 , 2x + 3y + 4z = 17 , y + 2z =7

26. Given three identical boxes I, II and III, each containing two coins. In box I, coins are gold coins, in box II, both are silver coins and in the box III, there is one gold and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold?

OR

A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six

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