MATHMETICS SAMPLE PAPER
CLASS – 12

SECTION-A

1. If $\vec{a}=7\hat{i}+\hat{j}-4\hat{k}$ and $\vec{b}=2\hat{i}+6\hat{j}-3\hat{k}$ then find the projection of $\vec{a}$ and $\vec{b}$
2. Find λ, if the vectors $\vec{a}=\hat{i}+3\hat{j}+\hat{k}, \vec{b}=2\hat{i}-\hat{j}-\hat{k}$ and $\vec{c}=\lambda+3\hat{k}$ are coplanar.
3. If a line makes angles 90^{o}, 60^{o} and θ with x, y and z-axis respectively, where θ is acute, then find θ.
4. Write the element a_{23} of a 3×3 matrix $A=(a_{ij})$ whose elements a_{ij} are given by $a_{ij}=\frac{|i-j|}{2}$
5. Find the differential equation representing the family of curves $\upsilon=\frac{A}{r}+B$, where A and B are arbitrary constants.
6. Find the integrating factor of the differential equation:
$$\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}}-\frac{y}{\sqrt{x}}\right)\frac{dx}{dy}=1$$

SECTION-B

7. If $A=\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{bmatrix}$, find $A^2-5A+4I$ and hence find a matrix X such that $A^2-5A+4I+X=0$.

OR

If $A=\begin{bmatrix}1 & -2 & 3\\ 0 & -1 & 4\\ -2 & 2 & 1\end{bmatrix}$, find $(A')^{-1}$

8. If $f(x)=\begin{vmatrix}a & -1 & 0\\ ax & a & -1\\ ax^2 & ax & a\end{vmatrix}$, using properties of determinants, find the value of f(2x) – f(x)
9. Find: $\int\frac{dx}{\sin x+\sin 2x}$

OR

Integrate the following w.r.t.x
$$\frac{x^2-3x+1}{\sqrt{1-x^2}}$$

10. Evaluate: $\int_{-n}^{n}(\cos ax-\sin bx)^2 dx$

11. A bag A contains 4 black and 6 red balls and bag B contains 7 black and 3 red balls. A die is thrown. If 1 or 2 appears on it, then bag A is chosen, otherwise bag B. If two balls are drawn at random (without replacement) from the selected bag, find the probability of one of them being red and another black.

OR

An unbiased coin is tossed 4 times. Find the mean and variance of the number of heads obtained.

12. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find $(\vec{r}\times\hat{i}).(\vec{r}\times\hat{j}) + xy$.

13. Find the distance between the point (-1, -5, -10) and the pint of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane x – y +z = 5.

14. If $\sin\left[\cot^{-1}(x+1)\right] = \cos(\tan^{-1}x)$, then find x.

15. If $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right), x^2 \leq$, then find $\frac{dy}{dx}$.

16. If x = a cos θ+b sin θ, y = a sin θ - b cos θ, show that $y^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$

17. The side of an equilateral triangle is increasing at the rate of 2cm/s. At what rate is its area increasing when the side of the triangle is 20 cm?

18. Find $\int (x+3)\sqrt{3-4x-x^2}dx$

19. Three schools A, B and C organized a mela for collecting funds for helping the rehabilitation of flood victims. They sold hand made fans, mats and plates from recycled material at a cost of Rs. 100 and Rs. 50 each. The number of articles sold are given below:

Article / School	A	B	C
Hand-fans	40	25	35
Mats	50	40	50
Pates	20	30	40

Find the funds collected by each school separately by selling the above articles. Also find the total funds collected for the purpose.
Write one value generated by the above situation.

20. Let N denote the set of all natural numbers and R be relation on $N \times N$ defined by (a, b) r (c, d) if ad(b +c) = bc(a + d). Show that R is an equivalence relation.

21. Using integration find the area of the triangle formed by positive x-axis and tangent and normal to the circle $x^2 + y^2 = 4$ at $(1, \sqrt{3})$.

OR

Evaluate $\int_1^3 (e^{2-3x} + x^2 + 1)dx$ as a limit of a sum.

22. Solve the differential equation:

$$(\tan^{-1}y - x)dy = (1+y^2)dx$$

OR

Find the particular solution of the differential equation $\frac{dy}{dx}=\frac{xy}{x^2+y^2}$ given that y = 1, when x =x.

23. If lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-1}{2}=\frac{z}{1}$ intersect, then find the value of k and hence find the equation of the plane containing these lines.

24. If A and B are two independent events such that $P\left(\overline{A}\cap B\right)=\frac{2}{15}$ and $P\left(A\cap\overline{B}\right)=\frac{1}{6}$, then find P(A) and P(B).

25. Find the local maxima and local minima, of the function f(x) = sin x – cos x, 0< x<2π. Also find the local maximum and local minimum values.

26. Find graphically, the maximum value of Z = 2+ 5y, , subject to constraints given below: 2x+4y ≤ 8, 3x + 4y ≤ 6, x + y ≤4, x ≥0, y ≥ 0