Year of Quality education 18th

Code No. **Series AG-4** CLASS XII **TMG-D/79/89**

- Please check that this question paper contains 3 printed pages.
- Code 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.
- Please check that this question paper contains 29 questions.

**General Instructions: -**

1. All questions are compulsory.
2. The question paper consists of 29 questions divided into three sections A, B and C. Section A contains 10 questions of 1 marks each, Section B is of 12 questions of 4 marks each and Section C is of 7 questions of 6 marks each.
3. Write the serial number of the question before attempting it.
4. If you wish to answer any question already answered, cancel the previous answer.
5. In questions where internal choices is provided. You must attempt only one choice.

## *MATHEMATICS*

**Time Allowed : 3 hours** **Maximum Marks : 100**

# PART – A

**1.** If $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$ & $\vec{b}=\hat{i}-3\hat{k}$, find $\left|\vec{b}\times 2\vec{a}\right|$.

**2.** Find the value of c and d if the plane 2x + 4y –cz + d = 0 will contain the line $\frac{x-1}{2}=\frac{y-3}{1}=\frac{z-1}{4}$.

**3.** Evaluate: $\int_{-\pi/2}^{\pi/2}\log\left(\frac{2-\sin x}{2+\sin x}\right)dx.$

**4.** If $|\vec{a}|=\sqrt{26}, |\vec{b}|=7$ & $|\vec{a}\times\vec{b}|=35$, find $\vec{a}.\vec{b}$.

**5.** Give an example of two non zero $2\times 2$ matrix A,B such that AB = 0 .

**6.** Let $f:R-\{-\frac{3}{5}\}\to R$ be a function as $f(x)=\frac{2x}{5x+3}$, Find $f^{-1}$ .

**7.** If A , B , C are three non zero square matrix of same order , find the condition on A such that $AB=AC \Rightarrow B=C$.

**8.** Find the values of $\lambda$ for which the homogeneous system of equations:
$$\begin{aligned}2x+3y-2z&=0\\2x-y+3z&=0\\7x+\lambda y-z&=0\end{aligned}$$
find non – trivial solutions.

**9.** If the probability that a man aged 60 will live to be 70 is 0.4, what is the prob. that out of 3 men now 60, at least 2 will live to be 70 ?



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**10.** Find the coordinates of the point on the curve $y = x^2 - 6x + 9$ where the normal is parallel to the line $y = x + 5$.

# PART – B

**11.** Prove that : $\tan\left[\frac{1}{2}\sin^{-1}\frac{2x}{1+x^2} + \frac{1}{2}\cos^{-1}\frac{1-y^2}{1+y^2}\right] = \frac{x+y}{1-xy}$.

**12.** Evaluate : $\int \frac{2\sin 2\phi - \cos\phi}{6 - \cos^2\phi - 4\sin\phi}\, d\phi$.

**13.** Let T be the set of all triangles in a plane with R as a relation in T given by $R = \{(T_1, T_2) :. T_1 \sim T_2\}$.Show that R is an equivalence relation. Consider three right angle triangles $T_1$ with sides 3, 4, 5, $T_2$ with sides 5, 12, 13 and $T_3$ with sides 6, 8, 10. Which triangles among $T_1$, $T_2$ and $T_3$ are related?

**14.** Prove that If $y = \cos(\cos x)$ ;Prove that $\frac{d^2y}{dx^2} - \cot x \frac{dy}{dx} + y\sin^2 x = 0$.

**15.** Given that $\cos\frac{x}{2}.\cos\frac{x}{4}.\cos\frac{x}{8}.... = \frac{\sin x}{x}$, prove that $\frac{1}{2^2}\sec^2\frac{x}{2} + \frac{1}{2^4}\sec^2\frac{x}{4} + ..... = \operatorname{cosec}^2 x - \frac{1}{x^2}$.

**OR**

If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, prove that $\frac{dy}{dx} = -\frac{1}{(x+1)^2}$.

**16.** Given $\vec{a} = 3\hat{i} - \hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$, express $\vec{b}$ as $\vec{b}_1 + \vec{b}_2$ where $\vec{b}_1$ is parallel is $\vec{a}$ & $\vec{b}_2$ is perpendicular to $\vec{a}$.

**OR**

If $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ & $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$, find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ & $\vec{b}$ and $\vec{c}.\vec{d} = 15$.

**17.** Using Lagrange's mean value theorem , find a point on the curve $y = \sqrt{x-2}$ defined on the interval [ 2, 3 ] , where the tangent is parallel to the chord joining the end points of the curve .

**18.** Evaluate: $\int \frac{\sqrt{x^2+1}[\log(x^2+1) - 2\log x]}{x^4} dx$

**19.** The sum of the mean and variance of a Binomials distribution is 15 and the sum of their squares is 117. Determine the distribution

**20.** Show that $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix} = a^3$.

**21.** Evaluate: $\int_{-1}^{3/2} |x\sin \pi x| dx$ .

**OR**

Evaluate $\int_0^4 (|x-1| + |x-2| + |x-3|)dx$.



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**22.** In a particular city , 24% of the families earn less then Rs 3 lac annually , 70% earn less then Rs8 lac annually . The probability that a family owns a car is 10% if earning are below Rs 3 lac 55% if earning is between Rs3 lac and Rs8 lac , and 90 % if earning is above Rs8 lac .If we know that a family does have a car , what is the probability that its earning is between 3 lac and 8 lac

**OR**

Let X be the random variable which assumes values 0,1,2,3 such that 3P(X=0)= 2P(X=1) = P(X=2) = 4P(X=3). Find the probability distribution of X .Also find mean and variance .

# PART – C

**23.** If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$, find $A^{-1}$ and hence solve the system of linear equations x+ 2y +z = 4 , - x + y + z = 0 , x – 3y + z = 2 .

**24.** A given quantity of metal is to be cast into a half cylinder with a rectangular base and semi- circular ends. Show that in order that the total surface area may be minimum , the ratio of the length of the cylinder to the diameter of its semi-circular ends is $\pi:(\pi+2)$.

**OR**

Show that the semi- vertical angle of a right circular cone of given surface area and maximum volume is $\sin^{-1}\left(\frac{1}{3}\right)$.

**25.** Find the vector and Cartesian equation of the plane containing the two lines $\vec{r} = 2i + j - 3k + \lambda(i + 2j + 5k)$ & $\vec{r} = 2i + j - 3k + \mu(3i - 2j + 5k)$ .
Also find the inclination of this plane with the XZ plane .

**26.** Sketch the graph $f(x) = \begin{cases} |x-2| + 2 & x \le 2 \\ x^2 - 2 & x \rangle 2 \end{cases}$.Evaluate $\int_0^4 f(x)dx$. What does this value represent on the graph?

**OR**

Find the area bounded by the curves $y = 6x - x^2$ & $y = x^2 - 2x$.

**27.** A housewife wishes to mix together two kinds of food $F_1$ & $F_2$ in such a way that the mixture contains atleast 10 units of vitamin A , 12 units of vitamin B and 8 units of vitamin C . The vitamin contents of one kg of foods $F_1$ & $F_2$ are as below :

| | VitaminA | VitaminB | VitaminC |
|---|---|---|---|
| Food $F_1$ | 1 | 2 | 3 |
| Food $F_2$ | 2 | 2 | 1 |

One kg of food $F_1$ costs Rs 6 and one kg of food $F_2$ costs Rs 10. Formulate the above problem as a linear programming problem, and use iso – cost method to find the least cost of the mixture which will produce the diet .

**28.** Prove that the image of the point ( 3 , -2 , 1 ) in the plane 3x – y + 4z = 2 lies on the plane x + y + z + 4 = 0 .

**29.** Solve the initial value problems: $\sqrt{1-y^2}\,dx = (\sin^{-1} y - x)\,dy$ , $y(0) = 0$ .

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