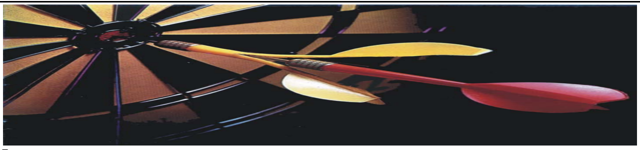

Year of Quality education 18th

Code No. **Series AG-4** CLASS XII **TMC -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. Prove that : $\frac{9\pi}{8}-\frac{9}{4}\sin^{-1}\frac{1}{3}=\frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$.

2. Prove that : $\sin\left(2\cos^{-1}\left(-\frac{3}{5}\right)\right)=-\frac{24}{25}$.

3. If a matrix has 18 elements, what are the possible orders it can have? What , if it has 5 elements?

4. Let relation $R=\{(x,y)\in w\times w : y=2x-4\}$. If (a , - 2) and $(4,b^2)$ belong to relation R, find the value of a and b .

5. Show that the matrix $B'AB$ is symmetric or skew symmetric according as A is symmetric or skew symmetric.

6. Find the value of k such that the plane 4 x + 4y – k z = 0 contain the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$.

7. Write down a unit vector in XY-plane, making an angle of 30° with the positive direction of *x*-axis.

8. If f (a + b – x) = f (x) , prove that $\int_a^b xf(x)dx=\frac{a+b}{2}\int_a^b f(x)dx$.

9. If $\vec{a}=2\hat{i}+2\hat{j}+3\hat{k},\vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+\hat{j}$ such that $\vec{a}+\lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ .

10. The vectors $\vec{a}=3\hat{i}+x\hat{j}-\hat{k}$ & $\vec{b}=2\hat{i}+\hat{j}+y\hat{k}$ are mutually perpendicular. Given that $|\vec{a}|=|\vec{b}|$, find the values of x and y .

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PART – B

11. Show that the function : $f(x) = \begin{cases} |x|, \text{if} x \le 2 \\ [x], \text{if} x > 2 \end{cases}$ is continuous on [0,2] .

12. If f(x) and g (x) be two invertible function defined as $f(x) = \dfrac{2x+1}{3x-5}$ be defined as $g(x) = \dfrac{3x+3}{7x-2}$. Prove that $(gof)^{-1} = f^{-1}og^{-1}$.

13. Find x if $\sin^{-1} x + \sin^{-1} 2x = \dfrac{\pi}{3}$.

14. Find the vector equation of the following plane in scalar product form $\vec{r} = (i - j) + \lambda(i + j + k) + \mu(i - 2j + 3k)$.

OR

Prove that the lines $\dfrac{X+4}{3} = \dfrac{Y+6}{5} = \dfrac{Z-1}{-2}$ and 3x-2y+z+5=0; 2x+3y+4z- 4=0 are coplanar . Also write the equation of plane in which they lie.

15. Find the intervals in which the function f given by $f(x) = \dfrac{4\sin x - 2x - x\cos x}{2 + \cos x}$ on $[0, 2\pi]$ is (i) increasing (ii) decreasing.

OR

A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi-vertical angle is $\tan^{-1}(0.5)$. Water is poured into it at a constant rate of 5 cubic meter per hour. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 4 m.

16. A girl walks 4 km towards west, then she walks 3 km in a direction 30° east of north and stops. Determine the girl's displacement from her initial point of departure.

OR

If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ & $\vec{b} = 3\hat{i} + \hat{j} + 2\hat{k}$, find a unit vector which is linear combination of $\vec{a}$ & $\vec{b}$ and is also perpendicular to $\vec{a}$.

17. If $y = \sin\left(\tan^{-1}\sqrt{\dfrac{1-x}{1+x}}\right)$ find $\dfrac{dy}{dx}$.

18. Using elementary transformation, find the inverse of the matrix. $\begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{bmatrix}$.

19. Solve the differential equation, $(1 + y + x^2 y)dx + (x + x^3)dy = 0$ where y = o when x = 1.

20. If each element of a second order determinant is either zero or one, what is the probability that the value of the determinant is positive?

21. Solve the differential equation, $ye^{x/y}dx = (xe^{x/y} + y)dy$.

22. Using limits of sum find the integral of $\int_1^3 (3x^2 + e^{2x})dx$. **OR** Evaluate: $\int_0^{3/2} |x \cos \pi x| dx$.

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PART – C

23. State the condition under which the following system of equations have a unique solutions. If A= $\begin{bmatrix} 9 & 7 & 3 \\ 5 & -1 & 4 \\ 6 & 8 & 2 \end{bmatrix}$,find A^{-1} and hence solve the following system of equations: 9x + 7y + 3z = 6; 5x – y + 4z = 1; 6x + 8y + 2z = 4 .

24. A helicopter is flying along the curve $y = x^2 + 2$. A soldier is placed at the point (3, 2). Find the nearest distance between the soldier and the helicopter.

OR

A tank with rectangular base and rectangular sides, open at the top is to be constructed so that its depth is 2m and volume is $8m^3$. If building of tank costs Rs70 per sq. metres for the base and Rs45 per square metre for sides. What is the cost of least expensive tank?

25. Find the equation of the plane passing through the points (1,1,1) and containing the line $\vec{r} = (-3\hat{i} + \hat{j} + 5\hat{k}) + \lambda(3\hat{i} - \hat{j} + 5\hat{k})$ .Also, show that the plane contains the line $\vec{r} = (-\hat{i} + 2\hat{j} + 5\hat{k}) + \lambda(\hat{i} - 2\hat{j} - 5\hat{k})$.

26. Draw the rough sketch of the region enclosed between the circles $x^2 + y^2 = 4$ and $(x-2)^2 + y^2 = 1$. Using integration, find the area of the enclosed region.

OR

Find the area lying above *x*-axis and included between the circle $x^2 + y^2 = 2ax$ and the parabola $y^2 = ax$.

27. Evaluate: $\int \tan^{-1} x^2 dx$.

28. A fruit grower can use two types of fertilizer in his garden, brand P and brand Q. The amounts (in kg) of nitrogen, phosphoric acid, potash, and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine. If the grower wants to minimize the amount of nitrogen added to the garden, how many bags of each brand should be used? What is the minimum amount of nitrogen added in the garden?

kg per bag		
	Brand P	Brand Q
Nitrogen	3	3.5
Phosphoric acid	1	2
Potash	3	1.5
Chlorine	1.5	2

29. Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduce the risk of heart attack by 30% and prescription of certain drug reduces its chances by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?

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