



**CODE:- AG-TS-4-7989**

**REGNO:-TMC-D/79/89/36/63**

**General Instructions :-**

- All questions are compulsory.
- The question paper consists of 26 questions divided into three sections A, B and C. Section – A comprises of 6 questions of 1 mark each. Section – B comprises of 13 questions of 4 marks each and Section – C comprises of 7 questions of 6 marks each.
- There is no overall choice. However, internal choice has been provided in 4 questions of four marks and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
- Use of calculator is not permitted.
- Please check that this question paper contains 8 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.

**सामान्य निर्देश :**

- सभी प्रश्न अनिवार्य हैं।
- इस प्रश्न पत्र में 26 प्रश्न हैं, जो 3 खण्डों में अ, ब, व स हैं। खण्ड – अ में 6 प्रश्न हैं और प्रत्येक प्रश्न 1 अंक का है। खण्ड – ब में 13 प्रश्न हैं और प्रत्येक प्रश्न 4 अंकों का है। खण्ड – स में 7 प्रश्न हैं और प्रत्येक प्रश्न 6 अंकों का है।
- प्रश्न संख्या 1 से 6 बहुविकल्पीय प्रश्न हैं। दिए गए चार विकल्पों में से एक सही विकल्प चुनें।
- इसमें कोई भी सर्वोपरि विकल्प नहीं है, लेकिन आंतरिक विकल्प 4 प्रश्न 4 अंकों में और 2 प्रश्न 6 अंकों में दिए गए हैं। आप दिए गए विकल्पों में से एक विकल्प का चयन करें।
- कैलकुलेटर का प्रयोग वर्जित है।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 4 हैं।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।

Time : 3 Hours

Maximum Marks : 100

**CLASS – XII**

**CBSE**

**MATHEMATICS**

**PART – A**

**Q.1** A matrix A of order 3 has determinant value 7. What is the value of |3A| ?

**Q.2** If  $R = \{(x, y) : x + 2y = 8\}$  is a relation on  $N$ , write the range of R.

<b>Q.3</b>	If $f(x) = \int_0^x t \sin t \, dt$ , then write the value of $f'(x)$ .
<b>Q.4</b>	What is the principal value of $\sin^{-1}\left(\cos \frac{\pi}{9}\right)$ ?
<b>Q.5</b>	Radius of a circle is increasing at the rate of 0.7 cm/s. Find the rate of increase of its circumference ?
<b>Q.6</b>	Find the angle between x-axis and the vector $\hat{i} + \hat{j} + \hat{k}$ .
<b>PART – B</b>	
<b>Q.7</b>	Solve the differential equation : $dy/dx + y \cot x = 2x + x^2 \cot x$ , $x = \pi/4, y = 1$ .
<b>Q.8</b>	Find the equation of a plane passing through the line of intersection of the planes. $x + 2y + 3z = 2$ and $x - y + z = 3$ and at a distance of $\frac{2}{\sqrt{3}}$ units from the points $(3, 1, -1)$ .
<b>Q.9</b>	Evaluate : $\int \cos 2\theta \log \left( \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta} \right) d\theta$ .
<b>Q.10</b>	Obtain the equation of tangent to the curves $x = a \sin^3 \theta$ , $y = b \cos^3 \theta$ at $\theta = \frac{\pi}{4}$ .
<b>Q.11</b>	Given that for the function $f(x) = x^3 - bx^2 + ax$ , $x \in [1, 3]$ , Rolle's Theorem holds with $c = 2 + \frac{1}{\sqrt{3}}$ . Find the values of a and b. <p style="text-align: center;"><b>OR</b></p> Show that $f(x) =  3x + 2 $ is not differentiable at $x = -2/3$ .
<b>Q.12</b>	Prove that : $\cos^{-1}(x) + \cos^{-1}\left(\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right) = \frac{\pi}{3}$ . <p style="text-align: center;"><b>OR</b></p> Solve for x : $\tan^{-1} x + 2 \cot^{-1} x = \frac{2\pi}{3}$ .

<b>Q.13</b>	<p>If <math>y = \tan^{-1}\left(\frac{x}{a}\right) + \log\sqrt{\frac{x-a}{x+a}}</math> : prove that <math>\frac{dy}{dx} = \frac{2ax^2}{x^4 - a^4}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>If <math>y = x \log\left(\frac{x}{a+bx}\right)</math> then, prove that <math>x^3 \frac{d^2y}{dx^2} = \left(x \frac{dy}{dx} - y\right)^2</math>.</p>
<b>Q.14</b>	<p>On the set <math>R - \{-1\}</math>, a binary operation is defined by <math>a * b = a + b + ab</math> for all <math>a, b \in R - \{-1\}</math>. Prove that <math>*</math> holds both commutative &amp; associative properties on <math>R - \{-1\}</math>. Find the identity element and prove that every element of <math>R - \{-1\}</math> is invertible.</p>
<b>Q.15</b>	<p>For any two vectors <math>\vec{a}</math> and <math>\vec{b}</math>, show that <math>(1 +  \vec{a} ^2)(1 +  \vec{b} ^2) = (1 - \vec{a} \cdot \vec{b})^2 +  \vec{a} + \vec{b} + \vec{a} \times \vec{b} ^2</math></p> <p style="text-align: center;"><b>OR</b></p> <p>The scalar product of the vector <math>\vec{a} = \hat{i} + \hat{j} + \hat{k}</math> with a unit vector along the sum of the vector <math>\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}</math> and <math>\vec{c} = \lambda\hat{i} + 2\hat{j} + 3\hat{k}</math> is equal to one. Find the value of <math>\lambda</math> and hence find the unit vector along <math>\vec{b} + \vec{c}</math>.</p>
<b>Q.16</b>	<p>Evaluate : <math>\int_0^{\pi} \frac{1}{5 + 4\cos x} dx</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>Evaluate : <math>\int_0^{\pi/2} \frac{x + \sin x}{1 + \cos x} dx</math>.</p>
<b>Q.17</b>	<p>(A) Show that the points (2,3,4), (-1, -2, 1) and (5, 8, 7) are collinear.</p> <p>(B) Evaluate the integral of <math>\int \tan^2 \frac{x}{2} dx</math>.</p> <p>(C) Let <math>A = [a_{ij}]</math> be a square matrix of order 3 and <math>C_{ij}</math> denotes the cofactor of <math>[a_{ij}]</math> in A. If <math> A  = 5</math>, then write the value of <math>a_{31}C_{31} + a_{32}C_{32} + a_{33}C_{33}</math>.</p> <p>(D) Find the value of <math>\mu</math> where it is given that <math>\mu = \hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{k} \times \hat{i}) + \hat{k} \cdot (\hat{i} \times \hat{j})</math>.</p>

<b>Q.18</b>	<p>A class has 15 students whose ages are 14,17,15,14,21,17,19,20,16,18,20,17,16,19 and 20 years. One student is selected in such a manner that each has the same chance of being chosen and the age X of the selected student is recorded. What is the probability distribution of the random variable X ? Find the mean of X.</p>
<b>Q.19</b>	<p>Using properties of determinants, prove that <math>\begin{vmatrix} x &amp; y &amp; x+y \\ y &amp; x+y &amp; x \\ x+y &amp; x &amp; y \end{vmatrix} = -2(x^3 + y^3)</math></p>
<b>PART - C</b>	
<b>Q.20</b>	<p>Using integration, find the area of the region: <math>\{(x,y): 9x^2 + y^2 \leq 36, 3x + y \geq 6\}</math> What is the important of integration in life.</p>
<b>Q.21</b>	<p>Prove that the image (3, -2, 1) in the plane <math>3x - y + 4z = 2</math> lies on the plane <math>x + y + z + 4 = 0</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>Find the distance of the point (-1, -5, -10) from the point of intersection of the plane <math>\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5</math> and the line <math>\vec{r} = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})</math>.</p>
<b>Q.22</b>	<p>Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is <math>\frac{2R}{\sqrt{3}}</math>. Also find the maximum volume.</p>
<b>Q.23</b>	<p>Evaluate : <math>\int_0^1 \sin^{-1}(x\sqrt{1-x} - \sqrt{x-x^3}) dx</math>.</p>
<b>Q.24</b>	<p>Assume that the chances of a patient having a heart attack is 40%. Assuming 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 chose any one of the two options with equal probabilities. It is given that after going though one of the two options, the patient selected at random suffers a</p>

	<p>heart attack. Find the probability that the patient followed a course of meditation and yoga. <b>Interpret the result &amp; state which of the above stated methods is more beneficial for the patient.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>There are three coins. one is two headed coin ( having head on both faces). Another is a biased coin that comes up heads 75% of the times and third is also a biased coin that comes up tails 40% of the times. One of the three coins is chosen at random and tossed, and it shows heads . What is the probability that it was the two headed coin .</p>
<b>Q.25</b>	<p>An amount of Rs. 600 crores is spent by the government in three schemes. Scheme A is for saving girl child from the cruel parents who don't want girl child and get the abortion before her birth. Scheme B is for saving of newlywed girls from death due to dowry. Scheme C is planning for good health for senior citizen. now twice the amount spent of Scheme C together with amount spend of Scheme. A is Rs. 700 crores. And three times the amount spent on Scheme A together with amount spent on Scheme B and Scheme C is Rs. 1200 crores. Find the amount spent on each Scheme using matrices. <b>What is the impertinence of saving girl child from the cruel parents who don't want girl child and get the abortion before her birth?</b></p>
<b>Q.26</b>	<p>A manufacturing company makes two types of teaching aids A and B of Mathematics for class. XII. Each type of A requires 9 labour hours of fabricating and 1 hour for finishing. Each type of B requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing the maximum labour hours available per week are 180 and 30 respectively. The company makes a profit of Rs. 80 on each piece of type A and Rs. 120 on each</p>

	<p>piece of type B. How many pieces of type A and type B should be manufactured per week to get a maximum profit ? Make it as an LPP and solve graphically. What is the maximum profit per week ?</p>
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	<p><b>IF, AT FIRST, YOU DO SUCCEED, TRY TO HIDE YOUR ASTONISHMENT</b></p>