CODE:TMC- AG-PB-2 **REG.NO:-TMC -D/79/89/36/63**

General Instructions :-

(i) **All** Question are compulsory :

(ii) This question paper contains **36** questions.

(iii) Question **1-20** in **PART- A are** Objective type question carrying **1** mark each.

(iv) Question **21-26** in **PART -B** are sort-answer type question carrying **2** mark each.

(v) Question **27-32** in **PART -C** are long-answer-**I** type question carrying **4** mark each.

(vi) Question **33-36** in **PART -D** are long-answer-**II** type question carrying **6** mark each

(vii) You have to attempt only one if the alternatives in all such questions.

(viii) Use of calculator is not permitted.

(ix) Please check that this question paper contains 8 printed pages.

(x) 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.

Time : 3 Hours — Maximum Marks : 80

CLASS – XII — **MATHEMATICS**

PRE-BOARD EXAMINATION 2019 -20

PART – A (Question 1 to 20 carry 1 mark each.)

SECTION I: Single correct answer type

This section contains 12 multiple choice question. Each question has four choices (A) , (B) , (C) &(D) out of which ONLY ONE is correct .

Q.1 If $A=\begin{pmatrix}1&2&3\\3&1&2\\2&3&1\end{pmatrix}$ and $B=\begin{pmatrix}-5&7&1\\1&-5&7\\7&1&-5\end{pmatrix}$ then AB is equal to

(a) I_3 (b) $2I_3$ (c) $4I_3$ (d) $18I_3$

Q.2 If $A=\begin{bmatrix}\alpha&0\\1&1\end{bmatrix}$ and $B=\begin{bmatrix}1&0\\5&1\end{bmatrix}$, then value of α for which $A^2=B$, is

(a) 1 (b) -1 (c) 4 (d) No real values

Q.3 If three vectors **a**, **b**, **c** satisfy $\mathbf{a}+\mathbf{b}+\mathbf{c}=\mathbf{0}$ and $|\mathbf{a}|=3$, $|\mathbf{b}|=5$, $|\mathbf{c}|=7$, then the angle between **a** and **b** is

(a) 30^o (b) 45^o (c) 60^o (d) 90^o

Q.4 The probability that a man can hit a target is $\frac{3}{4}$. He tries 5 times. The probability that he will hit the target at least three times is

(a) $\frac{291}{364}$ (b) $\frac{371}{464}$ (c) $\frac{471}{502}$ (d) $\frac{459}{512}$

Q.5	$\int \frac{\sin 2x}{1+\sin^2 x}dx =$ (a) $\log \sin 2x + c$ (b) $\log(1+\sin^2 x)+c$ (c) $\frac{1}{2}\log(1+\sin^2 x)+c$ (d) $\tan^{-1}(\sin x)+c$
Q.6	If $\tan^{-1}x + 2\cot^{-1}x = \frac{2\pi}{3}$, then $x =$ (a) $\sqrt{2}$ (b) 3 (c) $\sqrt{3}$ (d) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$
Q.7	An experiment succeeds twice as often as it fails. Find the probability that in 4 trials there will be at least three success (a) $\frac{4}{27}$ (b) $\frac{8}{27}$ (c) $\frac{16}{27}$ (d) $\frac{24}{27}$
Q.8	$\int \frac{x\,dx}{1-x\cot x} =$ (a) $\log(\cos x - x\sin x)+c$ (b) $\log(x\sin x - \cos x)+c$ (c) $\log(\sin x - x\cos x)+c$ (d) None of these
Q.9	The angle between the lines $\frac{x+4}{1}=\frac{y-3}{2}=\frac{z+2}{3}$ and $\frac{x}{3}=\frac{y-1}{-2}=\frac{z}{1}$ is (a) $\sin^{-1}\left(\frac{1}{7}\right)$ (b) $\cos^{-1}\left(\frac{2}{7}\right)$ (c) $\cos^{-1}\left(\frac{1}{7}\right)$ (d) None of these
Q.10	If the function $f(x)=\begin{cases}\frac{k\cos x}{\pi-2x}, & \text{when } x\neq\frac{\pi}{2}\\ 3, & \text{when } x=\frac{\pi}{2}\end{cases}$ be continuous at $x=\frac{\pi}{2}$, then $k =$ (a) 3 (b) 6 (c) 12 (d) None of these

Fill in the blanks (Q11 – Q15)

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Q.11	Find λ, μ = ...if $(2i+26j+27k)\times(i+\lambda j+\mu k)=0$.
Q.12	Let $A=\{1,2,3,4\}$. Let R be the equivalence relation on $A\times A$ defined by $(a,b)R(c,d)$ iff $a+d=b+c$. Find the equivalence class $[(1,3)]$.
Q.13	The number of all possible matrices of order 2 × 2 with each entry 1, 2 or 3 IS --------------.
Q.14	The perpendicular distance from (2,5,6) on XY plane is ------ .
Q.15	The acute angle which the line with direction cosines $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{6}}, n$ makes with positive direction of z-axis is ---------. **OR** The acute angle between the plane $5x-4y+7z-13=0$ and the y-axis is ----------.

(Q16 - Q20) Answer the following questions

Q.16	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 A.P.
Q.17	Evaluate: $\int_{-\pi/2}^{\pi/2} \frac{x^2}{1+5^x}dx$.
Q.18	Obtain a differential equation of the family of circles touching the x-axis at origin.
Q.19	Evaluate: $\int \frac{(x^2+\cos^2 x)\operatorname{cosec}^2 x}{1+x^2}dx$. **OR**

Target Mathematics by- Dr.Agyat Gupta
visit us: agyatgupta.com ; Resi.: D-79 Vasant Vihar ; Office : 89-Laxmi bai colony
Ph. : 4010685(O), 7000636110(O) Mobile : 9425109601(P)

	Evaluate: $\int \sqrt{1+\sin\frac{x}{4}}\,dx$.
Q.20	Find the value of a for which the function f (x) = $x^2 - 2ax + 6$ is increasing when x > 0. OR The income I of Dr. Rastogi is given by $I(x) = Rs.\ (x^3 - 3x^2 + 5x)$. Can an insurance agent ensure him for the growth of his income?
	PART – B **(Question 21 to 26 carry 2 mark each.)**
Q.21	Find the value of $3\sin^{-1}1 - 4\tan^{-1}(-\sqrt{3}) + 5\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \cos^{-1}1$. OR Prove that : $\tan^{-1}2 + \tan^{-1}3 = \frac{3\pi}{4}$.
Q.22	If $y = \tan^{-1}\left(\frac{x}{a}\right) + \log\sqrt{\frac{x-a}{x+a}}$: prove that $\frac{dy}{dx} = \frac{2ax^2}{x^4 - a^4}$.
Q.23	It is given that for the function f given by $f(x) = x^3 + ax^2 + bx, x \in [1,2]$ Rolle's theorem holds with $c = \frac{4}{3}$. Find the values of a and b.
Q.24	Decompose the vector $6i - 3\hat{j} - 6\hat{k}$ into vectors which are parallel and perpendicular to the vector $\hat{i} + \hat{j} + \hat{k}$. **OR** Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \vec{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ then If $c_2 = -1$ and $c_3 = 1$, find the value of c_1 can makes $\vec{a}, \vec{b}$ and $\vec{c}$.

Q.25	From the point P (a, b, c), perpendiculars PL and PM are drawn to YZ and ZX planes respectively. Find the equation of the plane OLM .
Q.26	A pair of fair dice is thrown. Find the probability that the sum is 10 or greater, if 5 appears on the first die.
	PART – C **(Question 27 to 32 carry 4 mark each.)**
Q.27	Show that function $f : R \to \{x \in R : -1 < x < 1\}$ defined by $f(x) = \frac{x}{1+\|x\|}, x \in R$,is one-one & onto function .
Q.28	Find whether the following function is differentiable at x = 1 and x = 2 or not : $f(x) = \begin{cases} x, & x < 1 \\ 2 - x, & 1 \le x \le 2 \\ -2 + 3x - x^2, & x > 2 \end{cases}$. **OR** If x= a sin pt, y = b cospt, then show that $\left(a^2 - x^2\right)y\frac{d^2y}{dx^2} + b^2 = 0$.
Q.29	Solve the differential equation : $x\frac{dy}{dx} + y - x + xy\cot x = 0; x \ne 0.$ OR The population of a village increases continuously at the rate proportional to the number of its inhabitants present at any time. If the population of the village was 20000 in 1999 and 25000 in the year 2004, what will be the population of the village in 2009?
Q.30	Evaluate : $\int_0^{\pi/4} \frac{\sec x}{1 + 2\sin^2 x}dx$.

OR

Evaluate: $\int \frac{\sin\ x}{\sin\ 4x}dx$.

Q.31 Three numbers are selected at random (without replacement) from first six positive integers. If X denotes the smallest of the three numbers obtained, find the probability distribution of X. Also find the mean and variance of the distribution.

OR

A shopkeeper sells three types of flower seeds A1, A2 and A3. They are sold as a mixture where the proportions are 4:4:2 respectively. The germination rates of three types of seeds are 45%, 60% and 35%. Calculate the probability (a) of a randomly chosen seed to germinate.(b) that it is of the type A2, given that a randomly chosen seed does not germinate.

Q.32 A toy company manufactures two types of dolls, A and B. Market tests and available resources have indicated that the combined production level should not exceed 1200 dolls per week and the demand for dolls of type B is at most half of that for dolls of type A. Further, the production level of dolls of type A can exceed three times the production of dolls of other type by at most 600 units. If the company makes profit of Rs 12 and Rs 16 per doll respectively on dolls A and B, how many of each should be produced weekly in order to maximize the profit?

PART – D **(Question 33 to 36 carry 6 mark each.)**

Q.33 Prove that : $\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(b+c)(c+a)(a+b)$.

OR

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For A = $\begin{bmatrix} 2 & 4 & 6 \\ 3 & -6 & 9 \\ 10 & 5 & -20 \end{bmatrix}$, find A^{-1} and hence solve the system of equations . $\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4$; $\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1$ & $\frac{6}{x}+\frac{9}{y}-\frac{20}{z}=2$.

Q.34 Find the area of the region $\{(x,y): x^2+y^2 \le 2ax, y^2 \ge ax, x \ge 0, y \ge 0\}$

Q.35 A cylinder of greatest volume is inscribed in a cone, show that Volume of the cylinder $=\frac{4}{27}\pi h^3 \tan^2 \alpha$. Where r, h, α are the radius, height and semi – vertical angle of the cone and R, H are the radius and height of the inscribed cylinder.

OR

A magazine seller has 500 subscribers and collects annual subscription charges of Rs, 300 per subscriber. She proposes to increase the annual subscription charges and it is believed that for every increase of Re 1, one subscriber will discontinue. What increase will bring maximum income to her ? Make appropriate assumptions in order to apply derivatives to reach the solution.

Q.36 Find the foot of the perpendicular from P(1, 2, 3) on the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$ .Also obtain the equation of the plane containing the line and the point (1, 2, 3).

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Target Mathematics by- Dr.Agyat Gupta
visit us: agyatgupta.com ; Resi.: D-79 Vasant Vihar ; Office : 89-Laxmi bai colony
Ph. : 4010685(O), 7000636110(O) Mobile : 9425109601(P)