Code No. **Series AG-F7** **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.

# *Pre-Board Examination 2009 -10*

***Time: 3 hrs.*** ***M.M.: 100***

## *CLASS – XII* *MATHEMATICS*

### Section A

| | |
|---|---|
| **Q.1** | Find the angle between the lines $\frac{x+1}{5}=\frac{y-2}{-2}=\frac{z-1}{2}$ & $\frac{x+3}{-2}=\frac{z-4}{3}, y=-5$. |
| **Q.2** | A line makes an angle of $\frac{\pi}{4}$ with each x-axis and y-axis. Find the angle between this line and the z-axis. |
| **Q.3** | Find the value of $x$ such that: $\begin{pmatrix} x & -5 & -1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{pmatrix} \begin{pmatrix} x \\ 4 \\ 1 \end{pmatrix} = 0$. |
| **Q.4** | Find the derivative of tan x w.r.t. sin x. |
| **Q.5** | If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that vector $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, find the value of $\lambda$. |
| **Q.6** | Show that the relation R on $N \times N$ defined by $(a,b)R(c,d)$ if and only if $ad = bc \forall a,b,c,d \in N$ is transitive. |
| **Q.7** | If P(A)=0.5, P(B)=0.6 and $P(A \cup B) = 0.8$, find P(A/B) . |
| **Q.8** | For the determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$, find $M_{12}$ and $C_{23}$ where $M_{12}$ is minor of the element in first row and second column and $C_{23}$ is cofactor of the element in second row and third column. |
| **Q.9** | If a binary operation $\oplus$ is defined by $a \oplus b = 2a - 3b$, find $8 \oplus 3$. |
| **Q.10** | Evaluate : $\int \frac{3x^2 + 4x - 5}{(x^3 + 2x^2 - 5x + 1)^2} dx$ . |



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## Section B

**Q.11** Let $\oplus$ be a binary operation on the set of natural numbers N given by $a \oplus b$ =L.C.M. of $a$ and $b$. Find (i) $5 \oplus 7$, $20 \oplus 16$ (ii) Is $\oplus$ commutative? (iii) Is $\oplus$ associative? (iv) Find identity element of $\oplus$ in N

**Q.12** A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the y-coordinate is changing 8 times as fast as the x-coordinate.

Or

Find the intervals in which the function $f(x) = \sin\left(2x + \frac{\pi}{4}\right), 0 \le x \le 2\pi$ is (i) increasing (ii) decreasing .

**Q.13** Using the properties of determinants, show that $\begin{vmatrix} 1 & a & a^2 \\ a^2 & 1 & a \\ a & a^2 & 1 \end{vmatrix} = \left(a^3 - 1\right)^2$.

**Q.14** Evaluate : $\int_0^{\pi/4} \frac{\tan^3 x}{1 + \cos 2x} dx$.

**Q.15** Find the values of $a$ and $b$ so that the function $f(x) = \begin{cases} ax^2 + b, & x < 2 \\ 2 & x = 2 \\ 2ax - b, & x > 2 \end{cases}$ may be continuous.

**Q.16** Solve the following differential equation : $x\frac{dy}{dx} - y(\log y - \log x + 1) = 0$.

Or

Solve the differential equation $x\frac{dy}{dx} + y = x\cos x + \sin x$ given that $y\left(\frac{\pi}{2}\right) = 1$.

**Q.17** Evaluate : $\int \frac{1}{\cos x + \operatorname{cosec} x} dx$.

**Q.18** Colored balls are distributed in four boxes as shown in the following table:

| Box | Color | | | |
|---|---|---|---|---|
| | Black | White | Red | Blue |
| I | 3 | 4 | 5 | 6 |
| II | 2 | 2 | 2 | 2 |
| III | 1 | 2 | 3 | 1 |
| IV | 4 | 3 | 1 | 5 |

A box is selected at random and then a ball is randomly drawn from the selected box. The color of the ball is black. Find the probability that ball drawn is from box III.

Or

3 bad eggs are mixed with 7 good ones. 3 eggs are taken at random from the lot. Find the probability distribution of number of bad eggs drawn. Find also the mean and variance of the probability distribution.

**Q.19** Find a vector of magnitude 11 units which is perpendicular to both the vectors $4\hat{i} - \hat{j} + 8\hat{k}$ and $-\hat{j} + \hat{k}$.

Or

If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$, find a vector $\vec{c}$ such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a}.\vec{c} = 3$.

**Q.20** Solve the equation $\tan^{-1}(x+1) + \tan^{-1}(x-1) = \tan^{-1}\left(\frac{6}{17}\right)$.



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| | |
|---|---|
| **Q.21** | If $y = x^x$, show that $\frac{d^2y}{dx^2} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 - \frac{y}{x} = 0$. |
| **Q.22** | A variable plane which remains at a constant distance of 9 units from the origin, cuts the coordinate axes at the points A, B and C. Show that the locus of the centroid of $\Delta ABC$ is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{9}$. |
| | **Section C** |
| **Q.23** | If $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$, find AB. Use the result to solve the following system of linear equations: 2x-y+z=-1 ; -x+2y-z=4 ; x-y+2z = - 3 . |
| **Q.24** | A diet for a sick person must contain at least 4000 units of vitamins, 50 units of minerals and 1400 calories. Two foods X and Y are available at a cost of Rs 4 and Rs 3 per unit respectively. One unit of food X contains 200 units of vitamins, 1 unit of minerals and 40 calories while one unit of food Y contains 100 units of vitamins, 2 units of minerals and 40 calories. Find what combination of foods X and Y should be used to have least cost, satisfying the requirement. |
| **Q.25** | Draw a rough sketch of $y^2 = x + 1$ and $y^2 = -x + 1$ and determine the area enclosed by the two curves. |
| **Q.26** | Show that the four point (0, -1, -1), (4, 5, 1), (3, 9, 4) and (-4, 4, 4) are coplanar. Also, find the equation of the plane containing them. |
| **Q.27** | In a test an examinee either guesses or copies or knows the answer to a multiple choice question with four choices. The probability that he makes a guess is $\frac{1}{3}$ and the probability that he copies the answer is $\frac{1}{6}$. The probability that his answer is correct given that he copied it is $\frac{1}{8}$. Find the probability that he knew the answer to the question given that he correctly answered it.<br>Or<br>In a school 8% of the boys and 2% of girls have an I.Q. of more than 120. In the school 60% of the students are boys. A student with I.Q. more than 120 is selected. Find the probability that the student selected is a boy. |
| **Q.28** | Determine whether or not the following pairs of lines intersect. If these intersect, find the point of intersection, otherwise obtain the shortest distance between them: $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda(3\hat{i} - \hat{j})$ . $\vec{r} = 4\hat{i} - \hat{k} + \mu(2\hat{i} + 3\hat{k})$ |
| **Q.29** | Show that the triangle of maximum area that can be inscribed in a given circle is an equilateral triangle.<br>Or<br>Water is running into a conical vessel 12 cm deep and 4 cm in radius at the rate of 0.2 cu cm/s. When the water is 6 cm deep, find at what rate is (i) The water is rising? ( ii) The water surface area increasing? |
| | ____________x___________ |



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