Year of Quality education 18th

Code No. **Series AG-FA** **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 maximum and minimum values, if any of $f(x) = \lvert\sin 3x\rvert - 3$. |
| **Q.2** | Find the direction cosines of x-axis. |
| **Q.3** | If the following matrix is skew symmetric, find the values of a, b, c. $A = \begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix}$ |
| **Q.4** | Evaluate: $\int (e^{x \log a} + e^{a \log x} + e^{a \log a})\, dx$. |
| **Q.5** | Evaluate : $\int \frac{dx}{x^2 (x^4 + 1)^{3/4}}$ . |
| **Q.6** | At what points of the ellipse $16x^2 + 9y^2 = 400$, does the ordinates decrease at the same rate at which the abscissa increase ? |
| **Q.7** | Find the inverse element of the binary relation $a \otimes b = a + b - 4$. |
| **Q.8** | The slope of tangent to curve $y = \frac{x-1}{x-2}$ at $x = 10$ . |
| **Q.9** | If $A^2 = A$ for $A = \begin{bmatrix} -1 & b \\ -b & 2 \end{bmatrix}$, then find the value of b . |
| **Q.10** | Find the value of $\sec^2 (\tan^{-1} 2)$. |
| | **Section B** |



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| | |
|---|---|
| **Q.11** | Define a binary operation * on the set {0, 1, 2, 3, 4, 5} as $a * b = \begin{cases} a+b, & \text{if } a+b<6 \\ a+b-6, & \text{if } a+b \geq 6 \end{cases}$ Show that zero is the identity for this operation and each element *a* of the set is invertible with $6 - a$ being the inverse of *a*. |
| **Q.12** | Find the intervals in which the function $f(x) = \sin\left(2x + \frac{\pi}{4}\right), 0 \leq x \leq 2\pi$ is (i) increasing (ii) decreasing . |
| **Q.13** | Using properties of determinant prove that $\begin{vmatrix} b+c & c+a & a+b \\ q+r & r+p & p+q \\ y+z & z+x & x+y \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}$. |
| **Q.14** | Evaluate : $\int_0^1 \sin^{-1}\left(x\sqrt{1-x} - \sqrt{x}\sqrt{1-x^2}\right)dx, 0 \leq x \leq 1$. **Or** Evaluate: $\int_0^{\pi/2} \sin 2x \tan^{-1}(\sin x)\, dx$ . |
| **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** | Find the particular solution of the differential equation $(xdy - ydx)y.\sin\left(\frac{y}{x}\right) = (ydx + xdy)x\cos\frac{y}{x}$, given that $y = \pi$ when x=3. **Or** Form a differential equation of the curve $xy = Ae^x + Be^{-x} + x^2$, A and B are arbitrary constants. |
| **Q.17** | Solve the differential equation: $\frac{d^2x}{dy^2} = y\sin^2 y$ . |
| **Q.18** | A pair of dice is thrown 7 times. If getting the total 7 is considered a success. Find the probability of (i) no success (ii) at least 6 success . Or The sum and the product of the mean and variance of a binomial distribution are 24 and 128 respectively. Find the distribution. |
| **Q.19** | Find a unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ & $\vec{a}-\vec{b}$ where $\vec{a} = 3i + 2j + 2k$ and $\vec{b} = i + 2j - 2k$ . |
| **Q.20** | If $y = \cot^{-1}(\sqrt{\cos x}) - \tan^{-1}(\sqrt{\cos x})$ Prove that $\sin y = \tan^2\frac{x}{2}$. |
| **Q.21** | If $y = e^{ax}\sin bx$ . Show that $\frac{d^2y}{dx^2} - 2a\frac{dy}{dx} + y(a^2 + b^2) = 0$ . **Or** If $y = x^x$ then prove 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 $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{9}$. |



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## Section C

**Q.23** Find the matrix P satisfying the matrix equation $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} p \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.

**Q.24** A company produces 2 types of steel trunks. It has machines A and B. For completing I type of the trunk, it requires 3 hours on machine A and 1 hrs on machine B, where as II type of the trunk requires 3 hrs on machine A and 2 hours on machine B. Machine A can work 18 hrs and machine B for 8hrs only per day. There is a profit of Rs.30/- on I type of the trunk and Rs.48/- on the II type of the trunk. How many trunks of each type should be produced every day to earn maximum profit? Solve the problem graphically.

**Q.25** Let the number of times a candidate applies for a job be X and P(X=x)denotes the probability that he will be selected x times. Given that

$$P(X = x) = \begin{cases} (k+1)x & ,\text{if } x = 0 \\ 2kx & ,\text{if } x=1 \text{ or } 2 \\ k(6-x), & \text{if } x = 3 \text{ or } 4 \text{ or } 5 \end{cases}$$

where k is a +ve real number.

(a) Find the value of k.(b) What is the probability that he will be selected exactly three times.(c) What is the probability that he will be selected at least once.(d) Find the mean and variance of the probability distribution of X .

**Q.26** Using integration, find the area of the two parabolas $4y^2 = 9x \;\&\; 3x^2 = 16y$ .Also find thew angle between two curves .

**or**

Prove that the curves $y^2 = 4x \;\&\; x^2 = 4y$ divide the area of square bounded by x = o , x = 4 , y = 4and y = 0 into three equal parts .

**Q.27** A toy company manufactures two types of dolls , A & B . Market tests and available recourses have indicated that the combined production level should not exceeds 1200 dolls per week and the demand for dolls of type B is at most of type A. Further the production level of dolls of type A can exceeds three times the production of dolls of other type by at most 6 units . If the company makes profit of Rs 12 and Rs. 15 per doll respectively on doll A and B ,how many each should be produce weekly in order to maximum profit ?

Ans $x \ge 0; y \ge o; x + y \le 1200 \;\; ; y \le \frac{x}{2}; x \le 3y + 600 \;\; ; P = 12x + 16y$

**Q.28** 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 .

**Q.29** 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 8m³. If building of tank cost Rs. 70 per square meters for the base and Rs. 45 per square meters for sides. What is the cost of least expensive tank?

Or

A cylinder of greatest volume is inscribed in a cone, show that (i) $R = \frac{2}{3} h \tan\alpha$ (ii) $H = \frac{1}{3} h$ (iii) Volume of the cylinder = $\frac{4}{27} \pi h^3 \tan^2 \alpha$ . (iv) r : R = 3 : 2. Where r, h, $\alpha$ are the radius, height and semi – vertical angle of the cone and R, H are the radius and height of the inscribed cylinder.

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