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CBSE 12th Mathematics 2009 Unsolved Paper Delhi Board

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CBSE 12th Mathematics 2009 Unsolved Paper Delhi Board

TIME - 3HR. | QUESTIONS - 29

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION - A

Question number 1 to 10 carry 1 mark each.

Q.1. Find the projection of \vec{a} on \vec{b} if $\vec{a} \cdot \vec{b} = 8$ and $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$. *1 mark*

Q.2. Write a unit vector in the direction of $\vec{a} = 2\hat{i} + 6\hat{j} + 3\hat{k}$. *1 mark*

Q.3. Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors. *1 mark*

Q.4. If matrix $A = [1 \ 2 \ 3]$, write AA' , where A' is the transpose of matrix A . *1 mark*

Q.5. Write the value of the determinant: *1 mark*

$$\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$$

Q.6. Using principle value, evaluate the following: *1 mark*

$$\sin^{-1}\left(\sin\frac{3\pi}{5}\right).$$

Q.7. Evaluate: *1 mark*

$$\int \frac{\sec^2 x}{3 + \tan x} dx.$$

Q.8. If: *1 mark*

$$\int_0^1 (3x^2 + 2x + k) dx = 0, \text{ find the value of } k.$$

Q.9. If binary operation $*$ on the set of integers Z , is defined by $a * b = a + 3b^2$, then find the value $2 * 4$. *1 mark*

Q.10. If A is an invertible matrix of order 3 and $|A| = 5$, then find $|\text{adj. } A|$. *1 mark*

SECTION – B

Question number 11 to 22 carry 4 marks each.

Q.11. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, show that $\vec{a} - \vec{b}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$. 4 marks

Q.12. Prove that: 4 marks

$$\sin^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{5}{13}\right) + \sin^{-1}\left(\frac{16}{65}\right) = \frac{\pi}{2}$$

OR

Solve for x :

$$\tan^{-1} 3x + \tan^{-1} 2x = \frac{\pi}{4}$$

Q.13. Find the value of λ so that the lines

$$\frac{1-x}{3} = \frac{7y-14}{2\lambda} = \frac{5z-10}{11} \text{ and } \frac{7-7x}{3\lambda} = \frac{y-5}{1} = \frac{6-z}{5}$$

Are perpendicular to each other. 4 marks

Q.14. Solve the following differential equation: 4 marks

$$\frac{dy}{dx} + y = \cos x - \sin x.$$

Q.15. Find the particular solution, satisfying the given condition, for the following differential equation: 4 marks

$$\frac{dy}{dx} - \frac{y}{x} + \operatorname{cosec}\left(\frac{y}{x}\right) = 0; y = 0 \text{ when } x = 1.$$

Q.16. Using properties of determinants, prove the following: 4 marks

$$\begin{vmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 1+3p+2q \\ 3 & 6+3p & 1+6p+3q \end{vmatrix} = 1.$$

Q.17. A die thrown again and again until three sixes are obtained. Find the probability of obtaining the third six in the sixth throw of the die. 4 marks

Q. 18. Differentiate the following function w.r.t.

$$x: x^{\sin x} + (\sin x)^{\cos x}. \text{ 4 marks}$$

Q. 19. Evaluate: 4 marks

$$\int \frac{e^x}{\sqrt{5 - 4e^x - e^{2x}}} dx$$

OR

Evaluate:

$$\int \frac{(x-4)e^x}{(x-2)^3} dx.$$

Q. 20. Prove that the relation R in the set

$A = \{1, 2, 3, 4, 5\}$ **given by** $R = \{(a, b) : |a - b| \text{ is even}\}$, **is an equivalence relation.** 4 marks

Q. 21. Find: 4 marks

$$\frac{dy}{dx} = \text{if } (x^2 + y^2)^2 = xy.$$

OR

If $y = 3 \cos(\log x) + 4 \sin(\log x)$, **then show that**

$$x^2 \cdot \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0.$$

Q. 22. Find the equation of the tangent to the curve $y = \sqrt{3x - 2}$ **which is parallel to the line** $4x - 2y + 5 = 0$. 4 marks

Or

Find the intervals in which the function f **given by** $f(x) = x^3 + \frac{1}{x^3}$, $x \neq 0$ **is**

(i) increasing (ii) decreasing.

SECTION-C

Question numbers 23 to 29 carry 6 marks each.

Q. 23. Find the volume of the largest cylinder that can be inscribed in a sphere of radius r .

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. metre for the base and Rs45 per sq. metre for sides, what is the cost of least expensive tank?

Q.24. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods F_1 and F_2 are available. Food F_1 costs Rs 4 per unit and F_2 costs Rs 6 per unit. One unit of food F_1 contains 3 units of vitamin A and 4 units of minerals. One unit of food F_2 contains 6 units of vitamin A and 3 units of minerals. Formulate this as a linear programming problem and find graphically the minimum cost for diet that consists of mixture of these two foods and also meets the minimal nutritional requirements. *6 marks*

Q.25. Three bags contain balls as shown in the table below:

Bag	Number of white balls	Number of black balls	Number of red balls
I	1	2	3
II	2	1	1
III	2	3	2

A bag is chosen at random and two balls are drawn from it. They happen to be white and red. What is the probability that they came the III bag? *6 marks*

Q.26. Using matrices, solve the following system of equation: *6 marks*

$$2x - 3y + 5z = 11$$

$$3x + 2y - 4z = -5$$

$$x + y - 2z = -3$$

Q.27. Evaluate: *6 marks*

$$\int_0^{\pi} \frac{e^{\cos x}}{e^{\cos x} + e^{-\cos x}} dx.$$

Or

Evacuate:

$$\int_0^{\pi/2} (2 \log \sin x - \log \sin 2x) dx$$

Q.28. Using the method of integration, find the area of the region bounded by the lines $2x + y = 4$, $3x - 2y = 6$ and $x - 3y + 5 = 0$. 6 marks

Q.29. Find the equation of the plane passing through the point $(-1, 3, 2)$ and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$. 6 marks



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