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CBSE 12th Mathematics 2009 Unsolved Paper Outside Delhi

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TIME - 3HR. | QUESTIONS - 29

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION - A

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Question numbers 1 to 10 carry 1 mark each.

Q.1 Find the value of x, if: 1 mark

$$\begin{pmatrix} 3x+y & -y \\ 2y-x & 3 \end{pmatrix} = \begin{pmatrix} 1 & 2 \\ -5 & 3 \end{pmatrix}.$$

- Q.2. Let * be a binary operation on N given by $a * b = HCF(a, b) a, b \in N$. Write the value of 22 * 4. 1 mark
- Q.3. Evaluate: 1 mark

$$\int_0^{1/\sqrt{2}} \frac{1}{\sqrt{1-x^2}} \, dx.$$

Q.4. Evaluate: 1 mar

$$\int \frac{\cos \sqrt{x}}{\sqrt{x}} \, dx.$$

Q.5. Write the principle value of: 1 mark

$$\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$$

Q.6. Write the value of the following determinant: 1 mark

$$\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$$

Q.7. Find the value of x from the following: 1 mark

$$\begin{vmatrix} x & 4 \\ 2 & 2x \end{vmatrix} = 0.$$

Q.8. Find the value of *p* if

$$(2\hat{\imath} + 6\hat{j} + 27\hat{k}) \times (\hat{\imath} + 3\hat{j} + p\hat{k}) = 0$$
. 1 mark

Q.9. Write the direction cosines of a line equally inclined to the three coordinate axes. 1 mark

Q.10. If \vec{p} is a unit vector and $(\vec{x} - \vec{p}) \times (\vec{x} + \vec{p}) = 80$, then find $|\vec{x}|$.

SECTION - B

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Question numbers 11 to 22 carry 4 marks each.

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Q.11. The length x of a rectangle is decreasing at the rate of 5cm/minute and the width y is increasing at the rate of 4cm/minute. When $x = 8 \ cm$ and $y = 6 \ cm$, find the rate of change of (a) the perimeter, (b) the area of the rectangle. 4 marks

OR

Find the intervals in which the function f given by

- $f(x) = \sin x + \cos x$, $0 \le x \le 2\pi$, is strictly increasing or strictly decreasing.
- **Q.12.** If $\sin y = x \sin(a + y)$, prove that: 4 marks

$$\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}.$$

If
$$(\cos x)^y = (\sin y)^x$$
, find $\frac{dy}{dx}$.

Q.13. Let $f: N \to N$ be defined by

$$f(n) = \begin{cases} \frac{n+1}{2}, & \text{if } n \text{ is odd} \\ \frac{n}{2}, & \text{if } n \text{ is even} \end{cases} \text{ for all } n \in \mathbb{N}.$$

Find whether the function f is bijective. 4 marks

Q.14. Evaluate: 4 marks

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

Evaluate:

 $\int x \sin^{-1} x \, dx$.

Q.15. If, 4 mark.

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 $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, show that

$$(1-x^2)\frac{d^2y}{dx^2}-3x\frac{dy}{dx}-y=0.$$

- Q.16. In a multiple-choice examination with three possible answer (out of which only one is correct) for each of the five questions, what is the probability that a candidate would get four or more correct answer just by guessing? 4 marks
- Q.17. 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.18. Solve the following differential equation: 4 marks

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$$x\frac{dy}{dx} = y - x\tan\left(\frac{x}{y}\right).$$

Q.19. Solve the following differential equation 4 marks

$$\cos^2 x \frac{dy}{dx} + y = \tan x.$$

Q.20. Find the shortest distance between the following two lines: 4 marks

$$\vec{r} = (1-\lambda)\hat{\imath} + (2-\lambda)\hat{\jmath} + (\lambda+1)\hat{k};$$
$$\vec{r} = (2\hat{\imath} - \hat{\jmath} - \hat{k}) + \mu(2\hat{\imath} + \hat{\jmath} + 2\hat{k}).$$

Q.21. Prove the following: 4 marks

$$\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)=\frac{x}{2}, x \in \left(0,\frac{\pi}{4}\right)$$

Ans.

OR

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Solve for $x: 2 \tan^{-1}(\cos x) = \tan^{-1}(2 \operatorname{cosec} x)$.

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Q.22. The scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with the unit vector along the sum of vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ is and $\pi\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ . 4 mark.

SECTION- C

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Question number 23 to 29 carry 6 marks each

- Q.23. Find the equation of the plane determined by the points A (3, -1, 2), B (5, 2, 4) and C (-1, -1, 6). Also find the distance of the point P(6, 5, 9) from the plane. 6 marks
- Q.24. Find the area of the region included between the parabola $y^2 = x$ and the line x + y = 2.6 marks
- Q.25. Evaluate: 6 marks

$$\int_{0}^{\pi} \frac{x \, dx}{a^2 \cos^2 x + b^2 \sin^2 x}$$

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

$$x + y + z = 6$$

$$x + 2z = 7$$

$$3x + y + z = 12$$

OR

Obtain the inverse of the following matrix using elementary operations;

$$A = \begin{bmatrix} 3 & 0 & -1 \\ 2 & 3 & 0 \\ 0 & 4 & 1 \end{bmatrix}$$

Q. 27. Colored balls are distributed in three bags as shown in the following table:

Bag	Colour of the ball		
	Black	White	Red
I	1	2	3
П	2	4	1
/ W	4	5	3
- C - 1	1 1 1	0 10 9	1

A bag is selected at random and them two balls are randomly drawn from the selected bag. they happen to be black and red. What is the probability that they came from bag I? 6 marks

Q.28. A manufacturer produces two products A and B. Both the products are processed on two different machine. The available capacity of first machine is 12 hours and that of second machine is 9 hours per day. Each unit of product a requires 3 hours on both machine and each unit of product B requires 2 hours on first machine and 1 hour on second machine. Each unit of product A is sold at Rs 7 profit and that of B at a profit of Rs 4. Find the production level per day for maximum profit graphically. 6 marks

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Q. 29. If the sum of the lengths of the hypotenuse and a side of a right- angled triangles is given, show that the area of the triangle is given, show that the area of the triangle is maximum when the angle between them is $\frac{\pi}{3}$. 6 marks

OR

A manufacturer can sell x items at a price of Rs $(5 - \frac{x}{100})$ each. The cost price of x item is Rs $(\frac{x}{5} + 500)$. Find the number of items he should sell to earn maximum profit.



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