CBSE 12th Mathematics 2008 Unsolved Paper
Outside Delhi

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TIME - 3HR. | QUESTIONS - 29

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION - A

Question number 1 to 10 carry 1 mark each.

Q.1. Let * be a binary operation defined by a * b = 2a + b -3. Find 3 * 4. *1 mark*

Q.2. Using principal value, evaluate the following: *1 mark*

$$cos^{-1}\left(cos\ \frac{2\pi}{3}\right) + sin^{-1}\left(sin\ \frac{2\pi}{3}\right).$$

Q.3. For what value of *x*, is the following matrix singular? *1 mark*

$$\begin{bmatrix} 3-2x & x+1 \\ 2 & 4 \end{bmatrix}$$

Q.4. Evaluate: *1 mark*

$$\begin{vmatrix} sin\ 30^0 & cos\ 30^0 \\ -sin\ 60^0 & cos\ 60^0 \end{vmatrix}$$

Q.5. A matrix A, of order 3 x 3, has determinant 4. Find the value of $|3A|$. *1 mark*

Q.6. Evaluate: *1 mark*

$$\int \frac{2cos\ x}{2\ sin^{\ 2}\ x}\ dx$$

Q.7. Evalute: *1 mark*

$$\int_0^1 \frac{2x}{1+x^2}\ dx.$$

Q.8. If $\vec{P}(1,5,4) and\ \vec{Q}(4,-1,-2), find\ the\ direction\ ratios\ of\ \overrightarrow{PQ}$. *1 mark*

Q.9. $If\ \vec{a} = \hat{\imath} + 2\hat{\jmath} - \hat{k}\ and\ \vec{b} = 3\hat{\imath} + \hat{\jmath} - 5\hat{k}\ find\ a\ unit\ vector\ in\ the\ direction\ of\ \vec{a} - \vec{b}$. *1 mark*

Q.10. if $|\vec{a}| = \sqrt{3}, |\vec{b}| = 2\ and\ \vec{a}.\vec{b} = 3$, find the angle between $\vec{a}.\ and\ \vec{b}$. *1 mark*

SECTION – B

Question numbers 11 to 22 carry 4 marks each.

Q.11. Show that the relation R defined by (a, b) R (c, d) ⇒a + d = b + c on the set N x N is an equivalence relation. *4 marks*

Q.12. Prove the following: *4 marks*

$$tan^{-1}\left(\frac{1}{3}\right) + tan^{-1}\left(\frac{1}{5}\right) + tan^{-1}\left(\frac{1}{7}\right) + tan^{-1}\left(\frac{1}{8}\right) = \frac{\pi}{4}$$

OR

Solve for x:

$$\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}.$$

Q.13. If *f(x)* defined by the following, is continuous at *x* = 0, find the values of a, b and c. *4 marks*

$$f(x) = \begin{cases} \dfrac{sin\,(a+1)x + sin\,x}{x} & ,if\ x < 0 \\ c & ,if\ x = 0 \\ \dfrac{\sqrt{x + bx^2} - \sqrt{x}}{bx^{3/2}} & ,if\ x \geq 0 \end{cases}$$

Q.14. If: *4 marks*

$$y = sin^{-1}\left[\frac{5x + 12\sqrt{1-x^2}}{13}\right], find\ \frac{dy}{dx}.$$

OR

If:

$$x = a\left(cos\,\theta + log\ tan\frac{\theta}{2}\right)\ and\ y = a\ sin\,\theta, find\ the\ value\ of\ \frac{dy}{dx}\ at\ \theta = \frac{\pi}{4}.$$

Q.15. Find the intervals in which the function *f(x)* =$2x^3 - 9x^2 + 12x + 15$ is (i) increasing and (ii) decreasing. *4 marks*

OR

At what points will the tangent to the curve $y = 2x^3 - 15x^2 + 36x - 21$ be parallel to x-axis? Also, find equations of tangents to the curve at those points.

Q.16. Evaluate: *4 marks*

$$\int_0^{\pi} \frac{x \tan x}{\sin x + \tan x} dx.$$

OR

Evaluate:

$$\int_0^{\frac{\pi}{2}} \log \sin x \, dx.$$

Q. 17. Solve the following differential equation: *4 marks*

$$(x^2 + 1)\frac{dy}{dx} + 2xy = \sqrt{x^2 + 4}\,.$$

Q. 18. Solve the following differential equation: *4 marks*

$$x^2 \frac{dy}{dx} = y^2 + 2xy. \text{ Given that } y = 1, \text{when } x = 1.$$

Q. 19. If vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are such that *4 marks*

$\vec{a} + \vec{b} + \vec{c} = 0$ *and* $|\vec{a}| = 3, |\vec{b}| = 5$ *and* $|\vec{c}| = 7$, *find the angle between* $\vec{a}$ *and* $\vec{b}$.

Q. 20. Find the length and the foot of the perpendicular drawn from the point *4 marks*

$$(2, \quad -1, \quad 5) \text{ to the line } \frac{x - 11}{10} = \frac{y + 2}{-4} = \frac{z + 8}{-11}.$$

Q. 21. 12 cards, numbered 1 to 12, are placed in a box, mixed up thoroughly and then a card is drawn at random from the box. If it is known that the number on the drawn card is more than 3, find the probability that it is an even number. *4 marks*

Q. 22. *If x, y, z are different and* *4 marks*

$$\begin{vmatrix} x & x^2 & 1 + x^3 \\ y & y^2 & 1 + y^3 \\ z & z^2 & 1 + z^3 \end{vmatrix} = 0, \text{show that } xyz = -1.$$

SECTION-C

Question numbers 23 to 29 carry 6 marks each.

Q. 23. Using matrices, solve the following system of linear equations: *6 marks*

$$x + 2y - 3z = -4$$
$$2x + 3y + 2z = 2$$
$$3x - 3y - 4z = 11.$$

OR

Using elementary transformations, find the inverse of the following matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{bmatrix}$$

Q.24. Show that the semi-vertical angle of the cone of maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$. *6 marks*

OR

Show that the volume of the greatest cylinder that can be inscribed in a cone of height h and semi-vertical angle α is $\frac{4}{27}\pi h^3 \tan^2 \alpha$.

Q.25. Evaluate: *6 marks*

$$\int_0^1 2\tan^{-1} x^2 \, dx.$$

Q.26. Find the area of the region bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. *6 marks*

Q.27. From the point P(1, 2, 4), a perpendicular is drawn on the plane $2x + y - 2z + 3 = 0$. Find the equation, the length, and the coordinates of the foot of the perpendicular. *6 marks*

Q.28. In a bulb factory, machines. A, B and C manufacture 60%, 30% and 10% bulbs respectively. 1%, 2% and 3% of the bulbs produced respectively by A, B and C are found to be defective. A bulb is picked up at random from the total production and found to be defective. Find the probability that this bulb was produced by the machine A. *6 marks*

Q.29. A diet for a sick person must contain at least 4000 units of vitamins, 50 units of minerals and 1400 units of calories. Two foods A and B are available at a cost of Rs5 and Rs4 per unit respectively. One unit of the food A contains 200 units of vitamins, 1 unit of minerals and 40 units of calories, while one unit of the food B contains 100 units of vitamins, 2 units of minerals and 40 units of calories. Find what combination of the foods A and B should be used to have least cost, but it must satisfy the requirements of the sick person. Form the question as LPP and solve it graphically. *6 marks*

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