CBSE 12th Mathematics 2016 Unsolved Paper

Delhi Board

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TIME - 3HR. | QUESTIONS - 26

THE MARKS ARE MENTIONED ON EACH QUESTION

Question numbers 1 to 6 carry 1 mark each.

Q.1. The two vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ represent the two sides AB and AC, respectively of a ΔABC. Find the length of the median through A. *1 mark*

Q.2. Find the vector equation of a plane which is at a distance of 5 units from the origin and its normal vector $2\hat{i}-3\hat{j}+6\hat{k}$. *1 mark*

Q.3. Find the maximum value of *1 mark*

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1 & 1 & 1+\cos\theta \end{vmatrix}$$

Q.4. If A is a square matrix such that $A^2 = I$, then find the simplified value of $(A-I)^3 + (A-I)^3 - 7A$. *1 mark*

Q.5. Matrix $A = \begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is given to be symmetric, find values of a and b. *1 mark*

Q.6. Find the position vector of a point which divides the join of points with position vectors $\vec{a}-2\vec{b}$ and $2\vec{a}+\vec{b}$ externally in the ratio 2 : 1. *1 mark*

SECTION – B

Question numbers 7 to 19 carry 4 marks each.

Q.7. Find the general solution of the following differential equation: *4 marks*

$$(1+y^2)+\left(x-e^{tan^{-1}y}\right)\frac{dy}{dx}=0$$

Q.8. Show that the vectors $\vec{a},\vec{b}$ and $\vec{c}$ are coplanar if $\vec{a}+\vec{b}$, $\vec{b}+\vec{c}$ and $\vec{c}+\vec{a}$ are coplanar. *4 marks*

Q.9. Find the Vector and Cartesian equation of the line through the point (1, 2, -4) and perpendicular to the two lines. *4 marks*

$$\vec{r}=\left(8\hat{i}-19\hat{j}+10\hat{k}\right)+\lambda\left(3\hat{i}-16\hat{j}+7\hat{k}\right) \text{ and}$$

$$\vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$$

Q.10. Three persons A, B and C apply for a job of Manager in a Private Company. Chances of their selection (A, B and C) are in the ratio 1 : 2 : 4. The probabilities that A, B and C can introduce change to improve profits of the company are 0.8, 0.5 and 0.3 respectively. If the change does not take place, find probability that it is due to the appointment of C. *4 marks*

OR

A and B throw a pair of dice alternately. A wins the game if he gets a total of 7 and B wins the game if he gets a total of 10. If A starts the game, then find the probability that B wins.

Q.11. Prove that: *4 marks*

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

OR

Solve for x:

$$2\tan^{-1}(\cos x) = \tan^{-1}(2\,\mathrm{cosec}\,x)$$

Q.12. The monthly incomes of Aryan and Babban are in the ratio 3:4 and their monthly expenditures are in the ratio 5:7 if each saves Rs.15,000 per month, find their monthly incomes using matrix method. This problem reflects which value? *4 marks*

Q.13. If $x = a\sin 2t(1 + \cos 2t)$ and $y = b\cos 2t(1 - \cos 2t)$, find the values of $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$ and $t = \frac{\pi}{3}$. *4 marks*

OR

If $y = x^x$, prove that

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

Q.14. Find the values of p and q, for which

$$f(x)\begin{cases} \dfrac{1 - \sin^2 x}{3\cos^2 x} & , if\ x < \dfrac{\pi}{2} \\ p & , if\ x = \dfrac{\pi}{2} \\ \dfrac{q(1 - \sin x)}{(\pi - 2x)^2} & , if\ x > \dfrac{n}{2} \end{cases}$$

is continuous at $x = \pi/2$. *4 marks*

Q.15.show the equation of normal at any point t on the curve $x = 3\cos t - \cos^3 t$ and $y = 3\sin t - \sin^3 t$ is $4(y\cos^3 t - x\sin^3 t) = 3\sin 4t$. 4 marks

Q.16. Find: 4 marks

$$\int \frac{(3\sin\theta - 2)\cos\theta}{5 - \cos^2\theta - 4\sin\theta}\, d\theta.$$

OR

Evaluate:

$$\int_0^{\pi} e^{2x} . \sin\left(\frac{\pi}{4} + x\right) dx$$

Q.17. Find: 4 marks

$$\int \frac{\sqrt{x}}{\sqrt{a^3 - x^3}}\, dx.$$

Q.18. Evaluate: 6 marks

$$\int_{-1}^{2} \left|x^3 - x\right| dx.$$

Q.19. Find the particular solution of the differential equation $(1 - y)^2(1 + \log x)\, dx + 2xy\, dy = 0$, given that $y = 0$ when $x = 1$. 4 marks

SECTION – C

Question numbers 20 to 26 question carry 6 marks each

Q.20. Find the coordinate of point P where the line through A (3, -4, -5) and B (2, -3, 1) crosses the plane passing through three points L (2, 2, 1), M (3, 0, 1) and N (4, -1, 0). Also, find the ratio in which P divides the line segment AB. 6 marks

Q.21. An urn contains 3white and 6 red balls. Four balls are drawn one by one with replacement from the urn. Find the probability distribution of the number of red balls drawn. Also find mean and variance of the distribution. 6 marks

Q.22. 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 Rs7 profit and that of B at a profit of Rs4. Find the production level per day for maximum profit graphically. 6 marks

Q.23. Prove that:

$$\begin{vmatrix} yz-x^2 & zx-y^2 & xy-z^2 \\ zx-y^2 & xy-z^2 & yz-x^2 \\ xy-z^2 & yz-x^2 & zx-y^2 \end{vmatrix}$$

is divisible by $(x+y+z)$, and hence find the quotient. *6 marks*

OR

Using elementary transformations, find the inverse of the matrix $A = \begin{pmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ and use it to solve the following system of linear equation:

$$\begin{aligned} 8x + 4y + 3z &= 19 \\ 2x + y + z &= 5 \\ x + 2y + 2x &= 7 \end{aligned}$$

Q.24. $\boldsymbol{Let\ f: N \to N}$ **be a function defined as** $\boldsymbol{f(x) = 9x^2 + 6x - 5.}$

$$\boldsymbol{show\ that\ f: N \to S,}$$

Where S is the range of f,is invertible. Find the inverse of f and hence find f^1 (43) and f^1 (163). *6 marks*

Q.25. Show that the altitude of the right circular cone of maximum volume that can be Inscribed in a sphere of radius r $is\ \frac{4r}{3}$. Also find maximum volume in terms of volume of the sphere *.6 marks*

OR

Find the intervals in which $f(x) = sin3x - cos3x, 0 < x < \pi$, is strictly increasing or strictly decreasing.

Q.26. Using integration find the area of the region *6 marks*

$$\{(x,y): x^2 + y^2 \le 2ax, y^2 \ge ax, x, y \ge 0\}$$


All
the Best