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CBSE 12th Mathematics 2014 Unsolved Paper Outside Delhi

TIME - 3HR. | QUESTIONS - 26

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION - A

Question number 1 to 10 carry 1 marks each.

Q.1. If $(R) = \{(x, y) : x + 2y = 8\}$ is a relation on \mathbb{N} , write the range of R . 1 mark

Q.2. If

$$\tan^{-1}x + \tan^{-1}y = \frac{\pi}{4}, xy < 1,$$

Then write the value of $x + y + xy$. 1 mark

Q.3. If A is a square matrix such that $A^2 = A$, then write the value of $7A - (I + A)^3$, where I is an identity matrix. 1 mark

Q.4. If $\begin{bmatrix} x-y & z \\ 2x-y & w \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ 0 & 5 \end{bmatrix}$, find the value of $x + y$. 1 marks

Q.5. If $\begin{vmatrix} 3x & 7 \\ -2 & 4 \end{vmatrix} = \begin{vmatrix} 8 & 7 \\ 6 & 4 \end{vmatrix}$, find the value of x . 1 mark

Q.6. If $f(x) = \int_0^x t \sin t dt$, then write the value of $f'(x)$. 1 mark

Q.7. Evaluate: 1 mark

$$\int_2^4 \frac{x}{x^2 + 1} dx.$$

Q.8. Find the value of 'p' for which the vectors $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} - 2p\hat{j} + 3\hat{k}$ are parallel. 1 mark

Q.9. Find $\vec{a} \cdot (\vec{b} \times \vec{c})$, if $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$. 1 mark

Q.10. If the Cartesian equation of a line are

$$\frac{3-x}{5} = \frac{y+4}{7} = \frac{2z-6}{4},$$

Write the vector equation for the line. 1 mark

SECTION – B

Question numbers 11 to 22 carry 4 marks each:

Q.11. If the function $f: R \rightarrow R$ be given by $f(x) = x^2 + 2$ and $g: R \rightarrow R$ be given by

$$g(x) = \frac{x}{x-1}, x \neq 1,$$

find $f \circ g$ and $g \circ f$ and hence find $f \circ g(2)$ and $g \circ f(-3)$. 4 marks

Q.12. Prove that: 4 marks

$$\tan^{-1} \left[\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}} \right] = \frac{\pi}{4} - \frac{1}{2} \cos^{-1} x, \quad \frac{-1}{\sqrt{2}} \leq x \leq 1.$$

OR

If

$$\tan^{-1} \left(\frac{x-2}{x-4} \right) + \tan^{-1} \left(\frac{x+2}{x+4} \right) = \frac{\pi}{4}, \text{ find the value of } x.$$

Q.13. Using properties of determinants, prove that: 4 marks

$$\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$$

Q.14. Find the value of

$$\frac{dy}{dx} \text{ at } \theta = \frac{\pi}{4},$$

if $x = ae^{\theta}(\sin \theta - \cos \theta)$ and $y = ae^{\theta}(\sin \theta + \cos \theta)$. 4 marks

Q.15. If $y = Pe^{ax} + Qe^{bx}$, show that: 4 marks

$$\frac{d^2y}{dx^2} - (a+b) \frac{dy}{dx} + aby = 0.$$

Q.16. Find the value(s) of x for which $y = [x(x-2)]^2$ is an increasing function. 4 marks

OR

Find the equations of the tangent and normal to the curve

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \text{ at the point } (\sqrt{2} a, b).$$

Q. 17. Evaluate:

$$\int_0^{\pi} \frac{4x \sin x}{1 + \cos^2 x} dx. \quad 4 \text{ marks}$$

OR

Evaluate: $\int \frac{x + 2}{\sqrt{x^2 + 5x + 6}} dx.$

Q. 18. Find the particular solution of the differential equation $\frac{dy}{dx} = 1 + x + y + xy,$

given that $y = 0$ when $x = 1.$ 4 marks

Q. 19. Solve the differential equation 4 marks

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

Q. 20. Show that the four points A, B, C and D with position vectors

$$4\hat{i} + 5\hat{j} + \hat{k}, -\hat{j} - \hat{k}, 3\hat{i} + 9\hat{j} + 4\hat{k} \text{ and } 4(-\hat{i} + \hat{j} + \hat{k})$$

respectively are coplanar. 4 marks

OR

The scalar product of the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors

$$\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k} \text{ and } \vec{c} = \lambda\hat{i} + 2\hat{j} + 3\hat{k} \text{ is equal to one.}$$

find the value of λ and hence find the unit vector along $\vec{b} + \vec{c}.$

Q. 21. A line passes through $(2, -1, 3)$ and is perpendicular to the lines

$$\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(2\hat{i} + 2\hat{j} - \hat{k}) \text{ and}$$

$$\vec{r} = (2\hat{i} - \hat{j} - 3\hat{k}) + \mu(\hat{i} + 2\hat{j} - 2\hat{k}).$$

Obtain its equation in vector and Cartesian form. 4 marks

Q. 22. An experiment succeeds thrice as often as it fails. Find the probability that in the next five trials, there will be at least 3 successes.

SECTION - C

Question numbers 23 to 29 carry 6 marks each.

Q. 23. Two school A and B want to award their selected students on the values of sincerity, truthfulness and helpfulness. The school A wants to award Rs x each, Rs y each and Rs z each for the three respective values to 3, 2 and 1 student respectively with a total award money of Rs 1,600. School B wants to spend rs 2,300 to award its 4, 1 and 3 student on the respective values (by giving the same award money to the three values as before). If the total amount of award for one prize on each value is rs 900, using matrices, find the award money for each value. A part from these three values, suggest one more value which should be considered for award. *6 marks*

Q.24. 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 show that the maximum volume of the cone $\frac{8}{27}$ of the volume of the sphere. *6 marks*

Q.25. Evaluate: *6 marks*

$$\int \frac{1}{\cos^4 x + \sin^4 x} dx.$$

Q26. Using integration, find the area of the region bounded by the triangle whose vertices are $(-1, 2)$, $(1, 5)$ and $(3, 4)$. *6 marks*

Q.27. Find the equation of the plane through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x + y + z = 0$. Also find the distance of the plane obtained above from the origin. *6 marks*

OR

Find the distance point $(2, 12, 5)$ from the point of intersection of the line

$$\vec{r} = 2\hat{i} - 4\hat{j} + 2\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k}) \text{ and the plane}$$

$$\vec{r} \cdot (\hat{i} - 2\hat{j} + \hat{k}) = 0.$$

Q.28. A manufacturing company makes two types of teaching aids A and B of Mathematics for class XII. Each of A requires 9 labour hours of fabricating and 1 labour hour for finishing. Each type of B requires 12 labour hours for fabricating and 3 labour hours for and finishing the maximum labour hours available per week are 180 and 30 respectively. The company makes a profit of Rs80 on each piece of type A and Rs120 on each piece of type B. How many pieces of type A type B Should be manufactured per week to get a maximum profit? Make it as an LPP and solve graphically. What is the maximum profit per week? *6 marks*

Q.29. There are three coins. One is a two – headed coin (having head on both faces), another is a biased coin that comes up heads 75 % of the times and third is also a biased coin that comes up tails 40 % of the times . one of the three coin is chosen at random and tossed, and it shows head. What the two – headed coin?

OR

Two numbers are selected at random (without replacement) from the first six positive integers. Let X denote the larger of the two numbers obtained. Find the probability distribution of the random variable X, and hence find the mean of the distribution.

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