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CBSE 12th Mathematics 2013 Unsolved Paper

Delhi Board

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TIME - 3HR. | QUESTIONS - 29

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION – A

Question numbers 1 to 10 carry 1 marks each.

Q.1. write the principal value of   *1 marks*

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

Q. 2. Write the value of $tan\left(2tan^{-1}\frac{1}{5}\right).$ *1 marks*

Q. 3. Find the value of a if

$$\begin{bmatrix} a - b & 2a + c \\ 2a - b & 3c + d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$$

Q. 4. *If* $\begin{vmatrix} x + 1 & x - 1 \\ x - 3 & x + 2 \end{vmatrix} = \begin{vmatrix} 4 & -1 \\ 1 & 3 \end{vmatrix}$, **then write the value of** x.   *1 marks*

Q. 5. *If* $\begin{bmatrix} 9 & -1 & 4 \\ -2 & 1 & 3 \end{bmatrix} = A + \begin{bmatrix} 1 & 2 & -1 \\ 0 & 4 & 9 \end{bmatrix}$, ***then find the matrix A***.   *1 marks*

Q. 6. Write the degree of differential equation   *1 marks*

$$x^3\left(\frac{d^2y}{dx^2}\right)^2 + x\left(\frac{dy}{dx}\right)^4 = 0.$$

Q. 7. *If* $\vec{a} = x\hat{\imath} + 2\hat{\jmath} - z\hat{k}$ ***and*** $\vec{b} = 3\hat{\imath} - y\hat{\jmath} + \hat{k}$ *1 marks*

   Are two equal vectors, then write the value of $x + y + z$.

Q. 8. If a vector $\vec{a}$ **makes angles** $\frac{\pi}{3}$ ***with*** $\hat{\imath}, \frac{\pi}{4}$ ***with*** $\hat{\jmath}$ ***and an acute angle*** θ ***with*** $\hat{k}$, **then find the value of** θ.   *1 marks*

Q. 9. Find the Cartesian equation of the line which passes through the point (-2, 4, -5) and is parallel to the line   *1 marks*

$$\frac{x + 3}{3} = \frac{4 - y}{5} = \frac{z + 8}{6}.$$

Q. 10. The amount of pollution content added in air in a city due to x- diesel vehicles is given by $P(x) = 0.005x^3 + 0.02x^2 + 30x$. Find the marginal increase in pollution content when 3 diesel vehicles are added and write which value is indicated in the above question.   *1 marks*

SECTION- B

Question numbers 11 to 22 carry 4 marks each.

Q. 11. Show that the function f in $A = R - \left\{\dfrac{2}{3}\right\}$ *4 marks*

Defined as $f(x) = \dfrac{4x+3}{6x-4}$ is $one - one$ and $onto.$ hence $find\ f^{-1}$.

Q.12. find the value of the following: *4 marks*

$$\tan\frac{1}{2}\left[\sin^{-1}\frac{2x}{1+x^2} + \cos^{-1}\frac{1-y^2}{1+y^2}\right]$$

$$|x| < 1, y > 0 \ and \ xy < 1.$$

OR

Prove that:

$$ten^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{8}\right) = \frac{\pi}{4}.$$

Q. 13. Using properties of determinants, prove the following: *4 marks*

$$\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1 - x^3)^2.$$

Q.14. differentiate the following function with respect to x :   *4 marks*

$$(\log x)^x + x^{\log x}$$

Q. 15. If $y = \log\left[x + \sqrt{x^2 + a^2}\right]$, *Show that*   *4 marks*

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

Q. 16. Show that function $f(x) = |x - 3|, x \in \mathbb{R},$ *4 marks*

Is continuous but not differentiable at $x = 3$.

OR

$$If\ x = a\ sin\ t\ and\ y = a\left(cos\ t + log\ tan\frac{t}{2}\right),$$

$$find\frac{d^2y}{dx^2}.$$

Q. 17. *Evaluate*: *4 marks*

$$\int \frac{sin(x-a)}{sin(x+4)}dx.$$

OR

Evaluate:

$$\int \frac{5x-2}{1+2x+3x^2}\ dx.$$

Q. 18. Evaluate: *4 marks*

$$\int \frac{x^2}{(x^2+4)(x^2+9)}dx.$$

Q.19. Evaluate: *4 marks*

$$\int_0^4 (|x| + |x-2| + |x-4|)dx.$$

Q.20. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a}+\vec{b}\right|^2 = |\vec{a}|$, then prove that vector $2\vec{a}+\vec{b}$ is perpendicular to vector $\vec{b}$ *4 marks*

Q.21. Find the coordinates of the point, where the line

$$\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{2}$$

Intersects the plane $x - y + z - 5 = 0$. Also find the angle between the line and the plane. *4 marks*

OR

Find the vector equation of the plane which contains the line of intersection of the planes $\vec{r}.\left(\hat{i}+2\hat{j}+\widehat{3k}\right) - 4 = 0$ and $\vec{r}.\left(2\hat{i}-2\hat{j}-\hat{k}\right) + 5 = 0$ and which is perpendicular to the plane $\vec{r}.(5\,\hat{i}+3\,\hat{j}-6\,\hat{k}) + 0.$

Q.22. **A speaks truth in 60% of the cases, while B in 90% of the cases. In what per cent of cases are they likely to contradict each other in stating the same fact ? in the case of contradiction do you think, the statement of B will carry more weight as statement of B will carry more weight as he speaks truth in more number of cases than A?** *4 marks*

SECTION – C

Question number 11 to 22 carry 4 marks each.

Q.23. **A school wants award its students for the value of honesty, regularity and hard work a total cash award of Rs6,000. Three times the award money for hard work added to that given for honesty amounts to Rs11,000. The award money given for Honesty and hard work together is double the one given for regularity Represent the above situation algebraically and find the award money for each value, using matrix method apart from these values namely, Honesty, Regularity and hard work, suggest one more value which the school must include for award.** *6 marks*

Q.24. **Find the equation of the normal at a point on the curve $x^2 = 4y$ which passes through the point (1,2). Also find the equation of the corresponding tangent.** *6 marks*

Q.25. **Using integration, find the area bounded by the curve $x^2 = 4y$ and the line**

$x = 4y - 2$. *6 marks*

OR

Using integration, find the area of the region enclosed between the two circles

$$x^2 + y^2 = 4 \; and \; (x - 2)^2 + y^2 = 4.$$

Q.26. **Show that the differential equation $2ye^{x/y} \, dx + \left(y - 2x \; e^{\frac{x}{y}} \right) dy = 0$ is homogeneous, find the particular solution of this differential equation, given that $x = 0$ when y = 1** *6 marks*

Q.27. **Find the equation of the plane passing through three points with position vectors**

$\hat{\imath} + \hat{\jmath} - 2\,\widehat{k}, -2\hat{\imath} - \hat{\jmath} + \widehat{k}$ **and $\hat{\imath} + 2\hat{\jmath} + \widehat{k}$.Also find the coordinates of the point of intersection of this plane and the line $\vec{r} = 3\hat{\imath} - \hat{\jmath} - \widehat{k} + \lambda(2\hat{\imath} - 2\hat{\jmath} + k)$.** *6 marks*

Q.28. **A cooperative society of farmers has 50 hectares of land to grow crops A and B. the profits from crops A and B per hectare are estimated as Rs 10,500 and Rs 9,000 respectively. To control weeds. A liquid herbicide has to be used for crops A and B at the rate 20 liters and 10 liters per hectare, respectively. Further not more than 800 liters of herbicide should be used in order to protect fish and wildlife using a pond which collects drainage from this land. Keeping than earing profit, how much land should be allocated to each crop so as to maximize the total profit ? from an LPP from the above and solve it graphically. Do you agree with the message that the protection of wildlife is utmost necessary to preserve the balance in environment?** *6 marks*

Q.29. **Assume that the chances of a patient having a heart attack is 40 % Assuming that a meditation and yoga course reduces the risk of heart attack by 30 % and prescription of certain drug reduces its chance by 25 % At a time a time a patient can choose any one of the two options with equal probabilities. Its is given that after going through one of the two option, the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga. Interpret the result meditation yoga. Interpret the result and state which of the above stated methods is more beneficial for the patient.** *6 mark*

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