DELHI BOARD [2009 CBSE XII MATHEMATICS]

Instructions

1. **All** questions are compulsory .
2. The question paper consists of 29 questions into three sections A,B and C. Section A comprises of 10 questions of one mark each, Section B comprises of 12 questions of four marks each and Section C comprises of 7 questions of six marks each.
3. All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.
4. There is no overall choice . However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculator is not permitted.

SECTION -A

1. Write the value of the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

   Answer: 0

2. If A is invertible matrix of order 3 and $|A|=5$, then find $|adj\, A|$.

   Answer: 25

3. Write the direction cosines of a line parallel to the line $\frac{3-x}{3}=\frac{y+2}{-2}=\frac{z+2}{6}$.

   Answer : $\left(\frac{-3}{7},\frac{-2}{7},\frac{6}{7}\right)$

4. Evaluate : $2\begin{vmatrix} 7 & -2 \\ -10 & 5 \end{vmatrix}$

   Answer: 30

5. . Evaluate the inetgral : $\int \frac{\sec^2 x}{3+\tan x}dx$

   Answer : $\log|3+\tan x|+C$

OR

Evaluate the inetgral : $\int \sec^2(7-x)\,dx$

Answer : $-\tan(7-x)+C$

6. Find the projection of $\vec{a}$ on $\vec{b}$, if $\vec{a}\cdot\vec{b}=8$ and $\vec{b}=2\hat{j}+6\hat{j}+3\hat{k}$.

Answer : $\frac{8}{7}$

7. Write a unit vector in the direction of $\vec{a}=2\hat{i}-6\hat{j}+3\hat{k}$.

Answer : $\frac{1}{7}(2\hat{i}-6\hat{j}+3\hat{k})$

8. Using principal values, evaluate the following $\cos^{-1}\left(\cos\frac{2\pi}{3}\right)+\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$.

Answer : π

OR

Using principal value, evaluate the following : $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$

Answer : $\frac{2\pi}{5}$

9. . Find the value of x from the following : $\begin{bmatrix} 2x-y & 5 \\ 3 & y \end{bmatrix}=\begin{bmatrix} 6 & 5 \\ 3 & -2 \end{bmatrix}$

Answer: $x=2$

10. If the binary operation $*$ on the set of integers Z is defined by a $*$ b = a + 3b2, then find the value $2*4$.

Answer: 50

SECTION B

11. Using properties of determinants, prove that $\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix}=(5x+4)(4-x)^2$

12. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when$|\vec{a}\times\vec{b}|=\sqrt{3}$.

Answer : $\frac{\pi}{3}$

13. Find the value of λ , so that the lines $\frac{1-x}{3}=\frac{7y-14}{2\lambda}=\frac{5z-10}{11}$ and $\frac{7-7x}{3\lambda}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular to each other.

Answer : $\lambda=7$

OR

Find the value of λ , so that the lines $\frac{1-x}{3}=\frac{7y-14}{2\lambda}=\frac{5z-10}{11}$ and $\frac{7-7x}{3\lambda}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular to each other.

Answer : $\lambda=-2$

14. Prove that the relation R in the set A = $\{1,2,3,4,5\}$ given by R = $\{(a,b) : |a - b|$ is even $\}$, is an equivalence relation.

15. . Evaluate the integral : $\int \frac{(x-4)\,e^x}{(x-2)^3}dx$

Answer : $\frac{e^x}{(x-2)^2}+C$

16. Evaluate the integral : $\int_0^{\pi} \frac{e^{\cos x}}{e^{\cos x}+e^{-\cos x}}dx$

Answer : $\frac{\pi}{2}$

17. Solve the following differential equation : $\frac{dy}{dx}+y=\cos x-\sin x.$

Answer: $y=\cos x+Ce^{-x}$

18. Find the intervals in which the function is increasing and decreasing : $f(x)=x^3-12x^2+36x+17.$

Answer: $(-\infty,2)\cup(6,\infty)\ (2,6)$

19. Differentiate following with respect to x. $(x)^{\cos x}+(\sin x)^{\tan x}$

Answer: $x^{\cos x}\left(\frac{\cos x}{x}-\sin x\log x\right)+\sin x^{\tan x}(1+\sec^2 x\log\sin x)$

OR

Find $\frac{dy}{dx}$, if $(x^2+y^2)^2=xy.$

Answer: $\frac{dy}{dx}=\frac{y-4x^3-4xy^2}{4x^2y+4y^3-x}$

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

Answer : $\pm\frac{1}{\sqrt{2}}$

21. Solve the following differential equation : $x\log x\frac{dy}{dx}+y=2\log x.$

Answer: $y\log x=(\log x)^2+C$

22. A dice is thrown again and again until three sixes are obtained. Find the probability of obtaining the third six in the sixth throw of the dice.

Answer: $\frac{625}{23328}$

SECTION - C

23. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods F_1 and F_2 are available. Food F_1 costs Rs. 4 per unit and F_2 costs Rs. 6 per unit. One unit of food F_1 contains 3 units of vitamin A and 4 units of minerals. One unit of food F_2 contains 6 units of vitamin A and 3 units of minerals. Formulate this as a linear programming problem and find graphically the minimum cost for diet that consists of mixture of these foods and also meets the minimal nutritional requirements.

Answer :
Minimum cost Rs. 104.

24. . Evaluate the integral using limits of sums : $\int_1^3 (2x^2+3)\,dx$

Answer : $\frac{70}{3}$

25. Find the area of the region enclosed between the two circles $x^2+y^2=9$ and $(x-3)^2+y^2=9$.

Answer : $\left(6\pi-\frac{9\sqrt{3}}{2}\right)$ sq. units

26. Find the equation of the plane passing through the point $(-1,3,2)$ and perpendicular to each of the planes $x+2y+3z=5$ and$3x+3y+z=6$.

Answer:$7x-8y+8z+25=0$

27. Show that the height of the cylinder of maximum voIume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also, find the maximum volume.

28. Three bags contain balls as shown in the following table :

Bags	Number of balls		
	White	Black	Red
I	1	2	3
II	2	1	1
III	4	3	2

A bag is chosen at random and two balls are drawn. They happen to be white and red. What is the probability that they come from the third bag? Answer: $\frac{5}{17}$

29. Obtain the inverse of the following matrix using elementary operations : n $A=\begin{bmatrix}3&0&-1\\2&3&0\\0&4&1\end{bmatrix}$

Answer:$A^{-1}=\begin{bmatrix}3&-4&3\\-2&3&-2\\8&-12&9\end{bmatrix}$

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