❀ CBSE CLASS XII MATHEMATICS - 2001

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. Evaluate : $\displaystyle\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} |\sin x|\, dx$

   Answer := $2 - \sqrt{2}$

2. Find the principal value of $sin^{-1}(\dfrac{\sqrt{3}}{2})$

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

3. Evaluate the inetgral : $\displaystyle\int \sin 5x \sin 3x\, dx$

   Answer : $\dfrac{1}{2}\left(\dfrac{\sin 2x}{2} - \dfrac{\sin 8x}{8}\right) + C$

4. Evaluate the inetgral : $\displaystyle\int \sin 7x \sin x\, dx$

   Answer : $\dfrac{1}{2}\left(\dfrac{\sin 6x}{6} - \dfrac{\sin 8x}{8}\right) + C$

5. Evaluate : $\int \left(x^2+5\right)^3 dx$

Answer : $\dfrac{x^7}{7}+3x^5+25x^3+125x+C$

6. . Determine order and degree (if defined) of differential equation $y''+2y'+\sin y=0$

Answer : the given differential equation is of order 2 and degree 1.

7. Write Minors and Cofactors of the elements of following determinant:

$\begin{vmatrix} 2 & -4 \\ 0 & 3 \end{vmatrix}$

Answer : $M_{11}=3, M_{12}=0, M_{21}=-4, M_{22}=2 \therefore C_{11}=3, C_{12}=-0=0, C_{21}=4, C_{22}=3$

8. What is the relation between the probability of events A,B and $A\cap B$ so that events A and B are independent ?

Answer : $P(A\cap B)=P(A).P(B)$

9. Find the equation of the plane with intercepts 2, 3 and 4 on the x, y and z-axis respectively.

Answer : $6x+4y+3z=12$

10. If a matrix has 24 elements, what are the possible orders it can have? What if, it has 13 elements?

Answer : The matrix with 13 elements has possible order 1 x 13 and 13 x 1.

SECTION -B

11. If $\vec{a}=4\hat{i}+3\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{k}$, then find $\left|2\vec{b}\times\vec{a}\right|$.

Answer : $\sqrt{504}$

OR

If $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times\vec{d}$, then prove that $\vec{a}-\vec{d}$ is parallel to $\vec{b}-\vec{c}$, provided that $\vec{a}\neq\vec{d}$ and $\vec{b}\neq\vec{c}$.

12. . Show that the line L whose vector equation is $\vec{r}=2\hat{i}-2\hat{j}+3\hat{k}+\lambda(\hat{i}-\hat{j}+4\hat{k})$, is parallel to the plane whose vector equation is $\vec{r}\cdot(\hat{i}+5\hat{j}+\hat{k})=5$ and find the distance between them.

Answer : $\dfrac{10}{\sqrt{27}}$ units

13. State whether the function $f:N>N$ given by f (x) = 5x is injective, surjective or both.

Answer : Injective but not surjective

14. Ramesh appears for an interview for two posts A and B for which selection is independent. The probability of his selection for post A is $1/6$ and for post B is $1/7$. Find the probability that Ramesh is selected for at least one of the posts.

Answer: $\dfrac{2}{7}$

15. . Evaluate the inetgral : $\int \dfrac{dx}{\sqrt{(2-x)^2+1}}$

Answer : $\log\left|\dfrac{1}{(2-x)+\sqrt{(2-x)^2+1}}\right|+C$

16. . $\int_0^\infty \dfrac{dx}{x^2+1}$

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

17. . Solve: $\dfrac{xdy}{dx} = y(\log y - \log x + 1)$.

Answer : $y = xe^{Cx}$

18. . Solve: $(x+2)\dfrac{dy}{dx} = 4x^2y$.

Answer : $\log|y| = 2x^2 - 8x + 16\log|x+2| + C$

19. Find the intervals in which function $f(x) = 2x^3 - 9x^2 + 12x + 30$ is increasing or decreasing.

Answer: $(-\infty, 1) \cup (2, \infty)$ $(1, 2)$

20. Find the equation of the tangent to the curve $x^2 + 3y = 3$ which is parallel to the line $y - 4x + 5 = 0$

Answer:$4x - y = -13$

21. For what value of k, is the function f(x) is continuous at x = 0? $f(x) = \begin{cases} \dfrac{\sin x + x\cos x}{x}, & when \quad x \neq 0 \\ k, & when \quad x = 0 \end{cases}$

Answer:$k = 2$

22. . Evaluate the integral : $\displaystyle\int \log\left(2 + x^2\right) dx$

Answer :$x\log\left|2 + x^2\right| - 2x + 2\sqrt{2}\tan^{-1}\left(\dfrac{x}{\sqrt{2}}\right) + C$

23. . If $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, then prove that A$-$AT is a skew symmetric matrix, where AT denotes the transpose of A.

SECTION -C

24. Show that the volume of the greatest cylinder which can be inscribed in a cone of height h and semi-vertical angle $30°$ is $\dfrac{4}{81}\pi h^3$

25. Find the distance of the point $(2, 3, 4)$ from the plane $3x + 2y + 2z + 5 = 0$ measured parallel to the line $\dfrac{x+3}{3} = \dfrac{y-2}{6} = \dfrac{z}{2}$.

Answer : 7 units

26. Using integration, find the area of the triangle ABC where A is $(2, 3)$, B is $(4, 7)$ and C is $(6, 2)$.

Answer :9 sq. units

27. . A speaks truth in 60% of the cases and B in 90% of the cases. In what percentage of cases are they likely to contradict each other in stating the same fact.

Answer:42%

OR

Using Binomial probability distribution, find the probability of obtaining less than 3 heads'' when an unbiased coin is tossed 6 times.

Answer: $\dfrac{11}{32}$

28. Integrate the following :

$$\int_0^\pi \dfrac{x}{a^2\cos^2 x + b^2\sin^2 x}dx$$

Answer : $\dfrac{\pi^2}{2ab}$

29. A manufacturer produces two types of steel trunks. He has two machines A and B. The first type of trunk requires 3 hours on machine A and 3 hours on machine B. The second type requires 3 hours on machine A and 2 hours on machine B. Machines A and B can work at most 18 hours and 15hours per day respectively. He earns a profit of Rs. 30 and Rs. 25 per trunk on the first type and second type respectively. How many trunks of each type must he make in each day to make maximum profit ?

Answer :
3 trunks of each type. maximum profit Rs. 165.

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