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CLASS XII
GUESS PAPER-01
MATHEMATICS

Time : 3 Hours | Maximum Marks : 100

GENERAL INSTRUCTIONS : *The question paper consists of 29 questions divided into three sections A, B & C. Section A comprises of 10 questions of 1 mark each, section B comprises of 12 questions of 4 marks each & section C comprises of 7 questions of 6 marks each.*

SECTION – A

1. If $f(x) = x^2 + 2$ and $g(x) = \frac{x}{x+1}$, find $(gof)(5)$.

2. What is the principal value of $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$?

3. If the position vector of the points A and B are $-3\hat{i} + 3\hat{j}$ and $4\hat{i} + 2\hat{k}$ respectively, then find a unit vector in the direction $\overrightarrow{AB}$.

4. If $\vec{a} = 3\hat{i} + 2\hat{j}$ and $\vec{b} = 2\hat{i} + 3\hat{j}$. Is $|\vec{a}| = |\vec{b}|$? Is $\vec{a} = \vec{b}$?

5. If $A = \begin{bmatrix} 2 & -1 \\ 0 & 3 \\ -1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -2 & 3 \\ 7 & 5 & -3 \end{bmatrix}$, then what are the orders of AB and BA.

6. If $A = \begin{bmatrix} 5 & -1 \\ -2 & 6 \end{bmatrix}$, determine whether A – A' is symmetric or skew symmetric.

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

8. Evaluate : $\int \frac{x^{e-1} + e^{x-1}}{x^e + e^x}\,dx$

9. Find the value of $\int_{-5}^{5} x^{18} \sin^{195} x\,dx$

10. If a line makes α, β, γ with the x-axis, y-axis and z-axis respectively, then find the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

SECTION – B

11. Let R be the relation defined in the set $A = \{1, 2, 3, 4, 5, 6, 7\}$ by $R = \{(a, b) : \text{both a and b are either odd or even}\}$. Show that R is an equivalence relation. Further, show that all the elements of the subset $\{1, 3, 5, 7\}$ are related to each other and all the elements of the subset $\{2, 4, 6\}$ are related to each other, but no element of the subset $\{1, 3, 5, 7\}$ is related to any element of the subset $\{2, 4, 6\}$.

12. Differentiate $x^{\sin x} + (\sin x)^{\cos x}$ with respect to *x*.

OR

If $y = Ae^{mx} + Be^{nx}$, show that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0$.

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

14. Solve the differential equation: $y + x\sin\left(\frac{y}{x}\right) = x\frac{dy}{dx}$.

15. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution number of tails.

16. Solve the differential equation: $(1 + x^2)\frac{dy}{dx} + y = \tan^{-1} x$.

17. Express the vector $\vec{a} = 5\hat{i} - 2\hat{j} + 5\hat{k}$ as sum of two vectors such that one is parallel to $\vec{b} = 3\hat{i} + \hat{k}$ and the other is perpendicular to $\vec{b}$.

18. If *a*, *b*, *c* are in A.P., then prove that $\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix} = 0$

OR

Express the matrix $A = \begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$ as the sum of a symmetric and skew-symmetric matrix.

19. Evaluate : $\int \frac{x^2+1}{(x+1)^2} e^x \, dx$ **OR** Evaluate : $\int \frac{1}{\sqrt{(2-x)^2+1}} \, dx$

20. Prove that : $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$.

OR

Prove that : $\sin^{-1}\frac{5}{13}+\cos^{-1}\frac{3}{5}=\tan^{-1}\frac{63}{16}$.

21. Find the shortest distance between the lines whose vector equations are :

$\vec{r}=(1-\lambda)\hat{i}+(\lambda-2)\hat{j}+(3-2\lambda)\hat{k}$, and $\vec{r}=(\mu+1)\hat{i}+(2\mu-1)\hat{j}-(2\mu+1)\hat{k}$

22. Find the value of *k* for which $f(x)=\begin{cases}\frac{\log(1+ax)-\log(1-bx)}{x}, & if\ x\neq 0\\ k, & if\ x=0\end{cases}$ is continuous at *x* = 0.

SECTION – C

23. Find the area bounded by the curve $x^2=4y$ and the line $x+2=4y$.

24. Evaluate : $\int_0^{\pi}\frac{x}{a^2\cos^2 x+b^2\sin^2 x}dx$ **OR** Evaluate : $\int_0^{\pi/2}\frac{1}{2\cos x+4\sin x}dx$

25. Find the vector equation of the plane passing through the points $2\hat{i}+\hat{j}-\hat{k}$ and $-\hat{i}+3\hat{j}+4\hat{k}$ and perpendicular to the plane $\vec{r}.(\hat{i}-2\hat{j}+4\hat{k})=10$.

26. Suppose that the reliability of a HIV test is specified as follows: Of people having HIV, 90% of the test detect the disease but 10% go undetected. Of people free of HIV, 99% of the test are judged HIV–ive but 1% are diagnosed as showing HIV+ive. From a large population of which only 0.1% have HIV, one person is selected at random, given the HIV test, and the pathologist reports him/her as HIV+ive. What is the probability that the person actually has HIV?

27. If A = $\begin{bmatrix}4 & -5 & -11\\ 1 & -3 & 1\\ 2 & 3 & -7\end{bmatrix}$, find A^{-1}. Using A^{-1}, solve the following system of linear equations :

$4x-5y-11z=12$, $x-3y+z=1$, $2x+3y-7z=2$.

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

OR

A square piece of tin of side 18 cm is to be made into a box without top by cutting a square from each corner and folding up the flops to form a box. What should be the side of the square to be cut off so that the volume of the box is maximum? Also find the maximum volume.

29. A manufacturing company makes two models A and B of a product. Each piece of Model A requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of Model B requires 12 labour

hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs 8000 on each piece of model A and Rs 12000 on each piece of Model B. How many pieces of Model A and Model B should be manufactured per week to realise a maximum profit? What is the maximum profit per week?