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SAMPLE PAPER (2011)
MATHEMATICS [XII]

No of Printed Pages:4 Maximum Marks :100

INSTRUCTIONS:

1. *There are twenty nine questions in this paper divided into three sections-: A, B and C.*
2. *Section A contains 10 questions of ONE mark each; Section B contains 12 questions of FOUR marks each; and Section C has 7 questions of SIX marks each.*
3. *Attempt all questions.*
4. *Rough work, if any, should be shown in the right hand margin(of approx. 2 inches) in the same page where the respective question has been solved.*

SECTION- A

1. Find x and y , if $2\begin{bmatrix}1 & 3\\0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\1 & 8\end{bmatrix}$
2. Find the angle between two vectors $\vec{a}$ *and* $\hat{b}$ with magnitude $\sqrt{3}$ and 2, respectively having $\vec{a}.\hat{b}=\sqrt{6}.$
3. Check whether the relation R in the set {1,2,3} given by R={(1,2),(2,1)} is transitive.
4. Find the value of $\tan^{-1}(\sqrt{3})-\sec^{-1}(-2).$
5. Determine the direction cosines of the normal to the plane $2x+3y-z=5$

6. Find the integral $\int_{0.2}^{3.5}[x]dx$

7. Find the projection of the vector $\hat{i}-\hat{j}$ on the vector $\hat{i}+\hat{j}$.

8. How many orders are possible for a matrix having 8 elements ?

9. Evaluate $\int\frac{\sin(\tan^{-1}x)}{1+x^2}dx$

10. Find x , if

$$\begin{vmatrix}2 & 3\\ 4 & 5\end{vmatrix}=\begin{vmatrix}x & 3\\ 2x & 5\end{vmatrix}$$

SECTION-B

11.Find the shortest distance between the lines

$$\vec{r}=\left(\hat{i}+\hat{j}\right)+\lambda\left(2\hat{i}-\hat{j}+\hat{k}\right)$$
$$and\ \ \hat{r}=(2\hat{i}+\hat{j}-\hat{k})+\mu(3\hat{i}-5\hat{j}+2\hat{k})$$

12. If x,y,z are all different and $\begin{vmatrix}x & x^2 & 1+x^3\\ y & y^2 & 1+y^3\\ z & z^2 & 1+z^3\end{vmatrix}$=0, then show that $xyz=-1$

13. Show that a function

$f:N\rightarrow N,\ given\ by\ f(x)=\begin{cases}x+1, if\ \ x\ is\ odd\\ x-1, if\ \ x\ is\ even\end{cases}$ is bijective.

14. Solve for x :: $\tan^{-1}\frac{x-1}{x-2}+\tan^{-1}\frac{x+1}{x+2}=\frac{\pi}{4}$

15. The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with the unit vector along the sum of vectors $2\hat{i}+4\hat{j}-5\hat{k}$ and $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to one . Find the value of

λ.

OR

If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, and $|\vec{a}|=3,\ |\vec{b}|=4,\ and\ |\vec{c}|=5$ .Find the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$.

16. Find the intervals in which the following function is increasing

$$f(x)=2x^3-15x^2+36x+17$$

17. Evaluate $\int_0^{3/2} |x\cos \pi x|\,dx$

18. Form the differential equation representing the family of parabolas having vertex at the origin and the axis along +ve x-axis.

19. Solve the following differential equation

$$\cos^2 x\frac{dy}{dx}+y=\tan x.$$

OR

$$x\frac{dy}{dx}-y=\sqrt{x^2+y^2}$$

20. An urn contains 5 white and 3 red balls. Find the probability distribution of the number of red balls, with replacements, in three draws.s

21. If $x^{\frac{2}{3}}+y^{\frac{2}{3}}=a^{\frac{2}{3}}$, Find $\frac{dy}{dx}$

OR

If $y=e^{a\cos^{-1}x}, -1\le x\le 1$ show that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}-a^2y=0$

22. Determine the values of a, b, c if the function

$$f(x)=\begin{cases}\dfrac{\sin(a+1)x+\sin x}{x} & if \quad x<0\\ c & if \quad x=0\\ \dfrac{\sqrt{x+bx^2}-\sqrt{x}}{bx^{3/2}} & if \quad x>0\end{cases}$$ is continuous at $x=0$

OR

Show that the function defined by $g(x)=x-[x]$ is discontinuous at all integral points. Hear $[x]$ denotes the greatest integer less than or equal to *x*.

SECTION-C

23. Draw a rough sketch indicating the following region and find its area:

$$\{(x,y): y^2 \le 4x,\ 4x^2+4y^2 \le 9\}$$

OR

$$\{(x,y): y^2 \le 3x,\ 3x^2+3y^2 \le 16\}$$

24. Prove that the semi-vertical angle of a right circular cone of given total surface area and maximum volume is $\sin^{-1}\dfrac{1}{3}$.

25 . Show that the lines $\frac{x-a+d}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$

and $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-b-c}{\beta+\gamma}$ are co-planer.

26. In answering a question on a multiple choice test a student either knows the answer or guesses. Let $\frac{3}{4}$ be the probability that he knows the answer and $\frac{1}{4}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with the probability $\frac{1}{4}$. What is the probability that the student knows the answer given that he answered it correctly.

27.Evaluate the following integral as the limit of a sum : $\int_0^2 (x^2+x+2)dx$

28.A manufacturer produces nuts and bolts. It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts. He earns a profit of Rs 17.50 per package on nuts and Rs. 7 per package on bolts. How many packages of each should be produced each day so as to maximize his profit, if he operates the machine for atmost 12 hours a day.

29. Solve the following system of equation by matrix method:

$$3x-2y+4z=2$$
$$2y-3z=1$$
$$x-y+2z=1$$

OR

If $A=\begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2, show that

$$I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$$

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