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MM. 100**Mathematics Mock Test XII March 2011****3 hours****1 Mark Each**

1. If $f(x)$ is an invertible function, find the inverse of $f(x) = \frac{3x-2}{5}$.
2. Show that, $\sin^{-1}(2x\sqrt{1-x^2}) = 2\sin^{-1}x$.
3. If $A' = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$, then find $(A+2B)'$.
4. If $A = \begin{bmatrix} \sin \alpha & \cos \alpha \\ -\cos \alpha & \sin \alpha \end{bmatrix}$, then verify that $A'A = I$.
5. Find the cofactor of a_{12} in the following: $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$
6. Evaluate the following integrals: $\int \frac{2 \cos x}{3 \sin^2 x} dx$.
7. Evaluate the following integrals: $\int \frac{x}{e^{x^2}} dx$.
8. For what value of λ are the vectors $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ perpendicular to each other?
9. If \vec{a} is unit vector and $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$, find $|\vec{x}|$.
10. Find the distance of the plane $x + y + 3z + 7 = 0$ from origin.

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3hours

4Mark Each

11. Show that the relation R defined by
 $R = \{(a, b) : a - b \text{ is divisible by } 3; a, b \in \mathbb{N}\}$ is an equivalence relation.

12. Prove that: $\tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$.

13. Using properties of determinants prove that:

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

14. Discuss the continuity of the function f(x) at x = 0, if

$$f(x) = \begin{cases} 2x - 1, & x < 0 \\ 2x + 1, & x \geq 0 \end{cases}$$

15. Differentiate, $\sec^{-1} \left(\frac{1}{2x^2 - 1} \right)$, w. r. t $\sqrt{1 - x^2}$.

16. Show that the semi-vertical angle of the right circular cone of maximum volume and given slant height, is $\tan^{-1} \sqrt{2}$.

17. $\int (a + b)^n dx = \frac{(ax + b)^{n+1}}{a(n+1)} + c, n \neq -1$, n is a rational number.

If $n = -1$. Then $\int \frac{1}{ax + b} dx = \frac{1}{a} \log|ax + b| + c$.

18. $3e^x \tan y dx + (1 - e^x) \sec^2 y dy = 0$, given that $y = \frac{\pi}{4}$, when $x = 1$.

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19. Solve each of the following differential equations:

$$\frac{dy}{dx} - x \sin^2 x = \frac{1}{x \log x}$$

20. If θ is angle between $\vec{a} = a_1 \hat{i} + b_1 \hat{j} + c_1 \hat{k}$ and $\vec{b} = a_2 \hat{i} + b_2 \hat{j} + c_2 \hat{k}$, then

$$\cos \theta = \frac{a_1 a_2 + b_1 b_2 + c_1 c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2} \sqrt{a_2^2 + b_2^2 + c_2^2}}$$

21. Find the image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

22. A problem in Mathematics is given to three students, whose chances of solving it are $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ what is the probability that the problem is solved?

6 Marks Each

23. If $f(x) = \begin{pmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{pmatrix}$, then show that $f(x) f(y) = f(x + y)$.

24. Show that the surface area of a closed cuboid with a square base and given volume is minimum, when it is a cube.

25. Evaluate: $\int \frac{1-x^2}{x(1-2x)} dx$.

26. Find the area of the region : $\{(x, y): y^2 \leq 4x, 4x^2 + 4y^2 \leq 9\}$.

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27. If θ is angle between line $\frac{x-x_1}{a_1} = \frac{y-y_1}{b_1} = \frac{z-z_1}{c_1}$ and the plane $ax+ by+ cz+ d=0$, then

$$\sin \theta = \frac{aa_1 + bb_1 + cc_1}{\sqrt{a^2 + b^2 + c^2} \sqrt{a_1^2 + b_1^2 + c_1^2}}.$$

If line is parallel to the plane, then $aa_1+bb_1+cc_1=0$ and,

If line is perpendicular to the plane, then $\frac{a}{a_1} = \frac{b}{b_1} = \frac{c}{c_1}$.

28. Two tailors A and B earn Rs.150 and Rs. 200 per day respectively. A can stitch 6 shirts and 4 pants per day while B can stitch 10 shirts and 4 pants per day. Form a liner programming problem to minimize the labour cost to produce at least 60 shirts and 32 pants.
29. A company has two plants to manufacture motor cycles.70% motorcycles are manufactured at the first plant, while 30% are manufactured at the second plant. At the first plant,80% motorcycles are rated of the standard quality while at the second plant,90% are rated of standard quality. A motorcycle , randomly picked up, is found to be of standard quality. Find the probability that it has come out from the second plant.

For Answers

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