Aimstutorial MODEL PAPER - 6

MATHS - 1A

SECTION - A

I. Answer ALL the following Very Short Answer Questions:

 $[10 \times 2 = 20]$

- 1. If: $R \rightarrow R$, g: $R \rightarrow R$ are defined by f(x) = 4x 1, $g(x) x^2 + 2$ then find (i) (gof)(x) (ii) fof(x)
- 2. Find the domain of the real function $f(x) = \sqrt{x^2 25}$.
- 3. If $A = \begin{bmatrix} 2 & -1 & 2 \\ 1 & 3 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -3 & 0 \\ 5 & 4 \end{bmatrix}$ then verify that (AB)' = B'A'.
- 4. If $A = \begin{bmatrix} a+ib & c+id \\ -c+id & a-ib \end{bmatrix}$, $a^2 + b^2 + c^2 + d^2 = 1$, then find the inverse of A.
- 5. Let $\overline{a} = 2\overline{i} + 4\overline{j} 5\overline{k}$, $\overline{b} = \overline{i} + \overline{j} + \overline{k}$, $\overline{c} = \overline{j} + 2\overline{k}$. Find unit vector in the opposite direction of $\overline{a} + \overline{b} + \overline{c}$.
- 6. Find the vector equation of the line passing through the points $2\overline{i} + \overline{j} + 3\overline{k}$, and parallel to the vector $4\overline{i} 2\overline{j} + 3\overline{k}$.
- 7. Find the unit vector perpendicular to the plane containing the vectors $\overline{a} = 4\overline{i} + 3\overline{j} \overline{k}$, $\overline{b} = 2\overline{i} 6\overline{j} 3\overline{k}$.
- 8. Prove that $(1+\cos\theta \csc\theta)(1 + \tan\theta + \sec\theta) = 2$
- 9. Find the extreme values of $3\sin^2 x + 5\cos^2 x$.
- 10. If sinhx = 3 then show that $x = \log(3 + \sqrt{10})$.

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II. Answer any FIVE of the following Short Answer Questions:

 $[5 \times 4 = 20]$

- 11. If $\theta \phi = \frac{\pi}{2}$, then show that $\begin{bmatrix} \cos^2 \theta & \cos \theta \sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta \end{bmatrix} \begin{bmatrix} \cos^2 \phi & \cos \phi \sin \phi \\ \cos \phi \sin \phi & \sin^2 \phi \end{bmatrix} = 0$.
- 12. In the two dimensional plane, prove by using vector methods, the equation of the line whose intercepts on the axes are 'a' and 'b' is $\frac{x}{a} + \frac{y}{b} = 1$.
- 13. If $\overline{a} = 2\overline{i} + \overline{j} \overline{k}$, $\overline{b} = -\overline{i} + 2\overline{j} 4\overline{k}$ $\overline{c} = \overline{i} + \overline{j} + \overline{k}$, find $(\overline{a} \times \overline{b})(\overline{b} \times \overline{c})$.
- 14. Show that $\frac{1}{\sin 10^{\circ}} \frac{\sqrt{3}}{\cos 10^{\circ}} = 4$.
- 15. Solve $1 + \sin^2\theta = 3 \sin\theta \cos\theta$
- 16. Prove that $\cos\left(2\tan^{-1}\frac{1}{7}\right) = \sin\left(2\tan^{-1}\frac{3}{4}\right)$.
- 17. In $\triangle ABC$, prove that $\tan \left(\frac{B-C}{2} \right) = \frac{b-c}{b+c} \cot \frac{A}{2}$

SECTION - C

III. Answer any FIVE of the following Long Answer Questions.:

 $[5 \times 7 = 35]$

- 18. If $f : A \rightarrow B$ is a function and $I_A : I_B$ are identity functions on A, B respectively then prove that $fol_A = f = I_B$ of .
- 19. Using the principle of finite Mathematical Induction prove that

$$1^2 + \left(1^2 + 2^2\right) + \left(1^2 + 2^2 + 3^2\right) + \dots \text{upto n terms} = \frac{n\left(n+1\right)^2\left(n+2\right)}{12} \; , \; \forall \, n \in N \, .$$

- 20. Show that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2 \begin{vmatrix} 2bc a^2 & c^2 & b^2 \\ c^2 & 2ac b^2 & a^2 \\ b^2 & a^2 & 2ab c^2 \end{vmatrix} = (a^3 + b^3 + c^3 3abc)^2.$
- 21. Solve the following system of equations by Guass-Jordan method x + y + z = 3, 2x + 2y z = 3, x + y z = 1.
- 22. If $\overline{a} = \overline{i} 2\overline{j} + 3\overline{k}$, $\overline{b} = 2\overline{i} + \overline{j} + \overline{k}$ $\overline{c} = \overline{i} + \overline{j} + 2\overline{k}$, then find $|(\overline{a} \times \overline{b}) \times \overline{c}|$.
- 23. If A + B + C = π , then prove that $\cos^2 \frac{A}{2} + \cos^2 \frac{B}{2} + \cos^2 \frac{C}{2} = 2\left(1 + \sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}\right)$.
- 24. If $r_1 = 2$, $r_2 = 3$, $r_3 = 6$ and r = 1, prove that a = 3, b = 4 and c = 5.

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