

# Aimstutorial MODEL PAPER - 1

## MATHS - 1A

### SECTION - A

I. Answer ALL the following Very Short Answer Questions:

[10 x 2 = 20]

1.  $A = \left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\right\}$  and  $f : A \rightarrow B$  is a surjection defined by  $f(x) = \cos x$  then find B.
2. Find the domain of the real valued function  $f(x) = \frac{1}{\log(2-x)}$ .
3. A certain bookshop has 10 dozen chemistry books, 8 dozen physics books, 10 dozen economics books. Their selling prices are Rs. 80, Rs. 60 and Rs. 40 each respectively. Find the total amount the bookshop will receive by selling all the books, using matrix algebra.
4. If  $A = \begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$ , then find  $A + A'$  and  $AA'$ .
5. Show that the points whose position vectors are  $-2\bar{a} + 3\bar{b} + 5\bar{c}$ ,  $\bar{a} + 2\bar{b} + 3\bar{c}$ ,  $7\bar{a} - \bar{c}$  are collinear when  $\bar{a}, \bar{b}, \bar{c}$  are non-coplanar vectors.
6. Let  $\bar{a} = 2\bar{i} + 4\bar{j} - 5\bar{k}$ ,  $\bar{b} = \bar{i} + \bar{j} + \bar{k}$ ,  $\bar{c} = \bar{j} + 2\bar{k}$ . Find unit vector in the opposite direction of  $\bar{a} + \bar{b} + \bar{c}$ .
7. If  $\bar{a} = \bar{i} + 2\bar{j} - 3\bar{k}$ ,  $\bar{b} = 3\bar{i} - 2\bar{j} + 2\bar{k}$ , then show that  $\bar{a} + \bar{b}$  and  $\bar{a} - \bar{b}$  are perpendicular to each other.
8. Prove that  $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} = \cot 36^\circ$ .
9. Find the period of the function defined by  $f(x) = \tan(x + 4x + 9x + \dots + n^2x)$ .
10. If  $\sinh x = 3$  then show that  $x = \log_e(3 + \sqrt{10})$ .

### SECTION - B

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

[5 x 4 = 20]

11. Show that  $\begin{vmatrix} bc & b+c & 1 \\ ca & c+a & 1 \\ ab & a+b & 1 \end{vmatrix} = (a-b)(b-c)(c-a)$ .
12. Let ABCDEF be regular hexagon with centre 'O'. Show that  $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$ .
13. If  $\bar{a} = \bar{i} - 2\bar{j} - 3\bar{k}$ ,  $\bar{b} = 2\bar{i} + \bar{j} - \bar{k}$  and  $\bar{c} = \bar{i} + 3\bar{j} - 2\bar{k}$ , find  $\bar{a} \times (\bar{b} \times \bar{c})$ .
14. If A is not an integral multiple of  $\frac{\pi}{2}$ , prove that  
i)  $\tan A + \cos A = 2 \operatorname{cosec} 2A$       ii)  $\cot A - \tan A = 2 \cot 2A$
15. Solve  $2\cos^2\theta - \sqrt{3} \sin \theta + 1 = 0$ .
16. Prove that  $\cos\left(2 \tan^{-1} \frac{1}{7}\right) = \sin\left(4 \tan^{-1} \frac{1}{3}\right)$ .
17. In  $\Delta ABC$ , 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 x 7 = 35]**

18. Let  $f : A \rightarrow B$ ,  $g : B \rightarrow C$  be bijections. Then prove that  $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ .

19. By using mathematical induction show that  $\frac{1}{4} + \frac{1}{4.7} + \frac{1}{7.10} + \dots$  (upto 'n' terms)  $= \frac{n}{3n+1}$ ,  $\forall n \in \mathbb{N}$ .

20. If  $A = \begin{bmatrix} 1 & -2 & 3 \\ 0 & -1 & 4 \\ -2 & 2 & 1 \end{bmatrix}$  than find  $(A')^{-1}$ .

21. Solve the following equations by Gauss-Jordan method  
 $3x + 4y + 5z = 18$ ,  $2x - y + 8z = 13$  and  $5x - 2y + 7z = 20$ .

22. If  $A = (1, -2, -1)$ ,  $B = (4, 0, -3)$ ,  $C = (1, 2, -1)$  and  $D = (2, -4, -5)$ , find the distance between  $\overline{AB}$  and  $\overline{CD}$ .

23. If  $A, B, C$  are angles of a triangle then prove that  $\sin^2 \frac{A}{2} + \sin^2 \frac{B}{2} - \sin^2 \frac{C}{2} = 1 - 2 \cos \frac{A}{2} \cos \frac{B}{2} \sin \frac{C}{2}$ .

24. In  $\Delta ABC$ , if  $a = 13$ ,  $b = 14$ ,  $c = 15$ , find  $R, r, r_1, r_2$  and  $r_3$ .

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