

Aimstutorial MODEL PAPER - 2

MATHS - 1A

SECTION - A

I. Answer ALL the following Very Short Answer Questions:

[10 x 2 = 20]

1. $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \frac{2x+1}{3}$, then this function is injection or not? Justify.
2. Find the domain of the real function $\log(x^2 - 4x + 3)$.
3. Find the trace of $\begin{bmatrix} 1 & 3 & -5 \\ 2 & -1 & 5 \\ 2 & 0 & 1 \end{bmatrix}$.
4. If $\begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew symmetric matrix then find the value of x .
5. Show that the triangle formed by the vectors $3\bar{i} + 5\bar{j} + 2\bar{k}$, $2\bar{i} - 3\bar{j} - 5\bar{k}$, $5\bar{i} - 2\bar{j} + 3\bar{k}$ is equilateral.
6. Find the vector equation of the line passing through the points $2\bar{i} + \bar{j} + 3\bar{k}$, $-4\bar{i} + 3\bar{j} - \bar{k}$.
7. If $|\bar{a} + \bar{b}| = |\bar{a} - \bar{b}|$ then find the angle between \bar{a} and \bar{b} .
8. Find the value of $\sin 34^\circ + \cos 64^\circ - \cos 4^\circ$.
9. Find the period of $f(x) = \cos(3x + 5) + 7$.
10. If $\sinh x = 3/4$ then find $\cosh 2x$ and $\sinh 2x$.

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SECTION - B

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

[5 x 4 = 20]

11. Show that the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$ is non-singular and find A^{-1} .
12. If the points whose position vectors are $3\bar{i} - 2\bar{j} - \bar{k}$, $2\bar{i} + 3\bar{j} - 4\bar{k}$, $\bar{i} + \bar{j} + 2\bar{k}$, $4\bar{i} + 5\bar{j} + \lambda\bar{k}$ are coplanar, then show that $\lambda = \frac{146}{17}$.
13. Find the area of the triangle formed with the points $A(1,2,3)$, $B(2,3,1)$, $C(3,1,2)$.
14. $\sin \frac{\pi}{5} \cdot \sin \frac{2\pi}{5} \cdot \sin \frac{3\pi}{5} \cdot \sin \frac{4\pi}{5} = \frac{5}{16}$.
15. Solve $\cot^2 x - (\sqrt{3} + 1) \cot x + \sqrt{3} = 0$.
16. Show that $2\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{5}{13}\right) = \cos^{-1}\left(\frac{323}{325}\right)$.
17. If $\cot \frac{A}{2} : \cot \frac{B}{2} : \cot \frac{C}{2} = 3 : 5 : 7$ then show that $a:b:c = 6:5:4$.

SECTION - C

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

[5 x 7 = 35]

18. If $f : A \rightarrow B$, $g : B \rightarrow C$ are two bijective functions then prove that $g \circ f : A \rightarrow C$ is also a bijective function.

19. Using the principle of finite Mathematical Induction prove that

$$2.3+3.4+4.5+\dots\text{upto } n \text{ terms} = \frac{n(n^2 + 6n + 11)}{3}.$$

20. Show that
$$\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = (a - b)(b - c)(c - a)(ab + bc + ca).$$

21. Solve the following equations by using Cramer's rule $2x - y + 3z = 9$, $x + y + z = 6$, $x - y + z = 2$.

22. Prove that the smaller angle θ between any two diagonals of a cube is given by $\cos\theta = 1/3$.

23. If A, B, C are angles in a triangle, then prove that $\sin^2A + \sin^2B - \sin^2C = 2\sin A \sin B \cos C$.

24. In ΔABC prove that $\frac{r_1}{bc} + \frac{r_2}{ca} + \frac{r_3}{ab} = \frac{1}{r} - \frac{1}{2R}$.