

Matrices - Class XII

Past Year JEE Questions

Questions

Question: 01

Let $\theta \in (0, \frac{\pi}{2})$. If the system of linear equations

$$(1 + \cos^2\theta)x + \sin^2\theta y + 4 \sin 3\theta z = 0$$

$$\cos^2\theta x + (1 + \sin^2\theta)y + 4 \sin 3\theta z = 0$$

$$\cos^2\theta x + \sin^2\theta y + (1 + 4 \sin 3\theta)z = 0$$

has a non-trivial solution, then the value of θ is :

- A. $\frac{4\pi}{9}$
- B. $\frac{7\pi}{18}$
- C. $\frac{\pi}{18}$
- D. $\frac{5\pi}{18}$

Solutions

Solution: 01

Explanation

$$\begin{vmatrix} 1 + \cos^2\theta & \sin^2\theta & 4 \sin 3\theta \\ \cos^2\theta & 1 + \sin^2\theta & 4 \sin 3\theta \\ \cos^2\theta & \sin^2\theta & 1 + 4 \sin 3\theta \end{vmatrix} = 0$$

$$C_1 \rightarrow C_1 + C_2$$

$$\begin{vmatrix} 2 & \sin^2\theta & 4 \sin 3\theta \\ 2 & 1 + \sin^2\theta & 4 \sin 3\theta \\ 1 & \sin^2\theta & 1 + 4 \sin 3\theta \end{vmatrix} = 0$$

$$R_1 \rightarrow R_1 - R_2, R_2 \rightarrow R_2 - R_3$$

$$\begin{vmatrix} 0 & -1 & 0 \\ 1 & 1 & -1 \\ 1 & \sin^2\theta & 1 + 4 \sin 3\theta \end{vmatrix} = 0$$

$$\text{or } 4 \sin 3\theta = -2$$

$$\sin 3\theta = -\frac{1}{2}$$

$$\theta = \frac{7\pi}{18}$$