

3 JEE Main 2021 (Online) 25th July Evening Shift
MCQ (Single Correct Answer)

The number of distinct real roots

of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is :

A 4

B 1

C 2

D 3

Explanation

$$\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0, \quad -\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$$

Apply : $R_1 \rightarrow R_1 - R_2$ & $R_2 \rightarrow R_2 - R_3$

$$\Rightarrow \begin{vmatrix} \sin x - \cos x & \cos x - \sin x & 0 \\ 0 & \sin x - \cos x & \cos x - \sin x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$$

$$\Rightarrow (\sin x - \cos x)^2 \begin{vmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$$

$$\Rightarrow (\sin x - \cos x)^2 (\sin x + 2\cos x) = 0$$

$$\therefore x = \frac{\pi}{4}$$