

Determinants - Class XII

Past Year JEE Questions

Questions

Question: 01

Let m and M be respectively the minimum and maximum values of

$$\begin{vmatrix} \cos^2 x & 1 + \sin^2 x & \sin 2x \\ 1 + \cos^2 x & \sin^2 x & \sin 2x \\ \cos^2 x & \sin^2 x & 1 + \sin 2x \end{vmatrix}$$

Then the ordered pair (m, M) is equal to :

- A. $(-3, -1)$
- B. $(-4, -1)$
- C. $(1, 3)$
- D. $(-3, 3)$

Solutions

Solution: 01

Explanation

$$\begin{vmatrix} \cos^2 x & 1 + \sin^2 x & \sin 2x \\ 1 + \cos^2 x & \sin^2 x & \sin 2x \\ \cos^2 x & \sin^2 x & 1 + \sin 2x \end{vmatrix}$$

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

$$\begin{vmatrix} -1 & 1 & 0 \\ 1 & 0 & -1 \\ \cos^2 x & \sin^2 x & 1 + \sin 2x \end{vmatrix}$$

$$= -1(\sin^2 x) - 1(1 + \sin 2x + \cos^2 x)$$

$$= -\sin 2x - 2$$

$$\therefore \text{minimum value when } \sin 2x = 1$$

$$m = -2 - 1 = -3$$

$$\therefore \text{Maximum value when } \sin 2x = -1$$

$$M = -2 + 1 = -1$$

$$\therefore (m, M) = (-3, -1)$$