

Trigonometric Equations

JEE Main 2021 (July) Chapter-wise Questions

Questions with Answer Keys

MathonGo

Q1 (22 July 2021 Shift 1)

The number of solutions of $\sin^7 x + \cos^7 x = 1$, $x \in [0, 4\pi]$ is equal to

(1) 11

(2) 7

(3) 5

(4) 9

Q2 (25 July 2021 Shift 1)

The sum of all values of x in $[0, 2\pi]$, for which

$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$, is equal to :

(1) 8π

(2) 11π

(3) 12π

(4) 9π

#MathBoleTohMathonGo

Trigonometric Equations

JEE Main 2021 (July) Chapter-wise Questions

Questions with Answer Keys

MathonGo

Answer Key

Q1 (3)

Q2 (4)

Trigonometric Equations

JEE Main 2021 (July) Chapter-wise Questions

Hints and Solutions

MathonGo

Q1 mathongo mathongo mathongo mathongo mathongo mathongo mathongo mathongo

$\sin^7 x \leq \sin^2 x \leq 1 \dots (1)$ mathongo mathongo mathongo mathongo mathongo mathongo

and $\cos^7 x \leq \cos^2 x \leq 1 \dots (2)$ mathongo mathongo mathongo mathongo mathongo mathongo

also $\sin^2 x + \cos^2 x = 1$ mathongo mathongo mathongo mathongo mathongo mathongo

\Rightarrow equality must hold for (1)&(2) $\Rightarrow \sin^7 x = \sin^2 x \& \cos^7 = \cos^2 x$ mathongo mathongo mathongo mathongo

$\Rightarrow \sin x = 0 \& \cos x = 1$ mathongo mathongo mathongo mathongo mathongo mathongo

or mathongo mathongo mathongo mathongo mathongo mathongo mathongo

$\cos x = 0 \& \sin x = 1$ mathongo mathongo mathongo mathongo mathongo mathongo mathongo

$\Rightarrow x = 0, 2\pi, 4\pi, \frac{\pi}{2}, \frac{5\pi}{2}$ mathongo mathongo mathongo mathongo mathongo mathongo

$\Rightarrow 5$ solutions mathongo mathongo mathongo mathongo mathongo mathongo

mathongo mathongo mathongo mathongo mathongo mathongo mathongo

Q2

($\sin x + \sin 4x$) + ($\sin 2x + \sin 3x$) = 0 mathongo mathongo mathongo mathongo mathongo mathongo

$\Rightarrow 2 \sin \frac{5x}{2} \left\{ \cos \frac{3x}{2} + \cos \frac{x}{2} \right\} = 0$ mathongo mathongo mathongo mathongo mathongo mathongo

$\Rightarrow 2 \sin \frac{5x}{2} \left\{ 2 \cos x \cos \frac{x}{2} \right\} = 0$ mathongo mathongo mathongo mathongo mathongo mathongo

$2 \sin \frac{5x}{2} = 0 \Rightarrow \frac{5x}{2} = 0, \pi, 2\pi, 3\pi, 4\pi, 5\pi$ mathongo mathongo mathongo mathongo mathongo

$\Rightarrow x = 0, \frac{2\pi}{5}, \frac{4\pi}{5}, \frac{6\pi}{5}, \frac{8\pi}{5}, 2\pi$ mathongo mathongo mathongo mathongo mathongo mathongo

$\cos \frac{x}{2} = 0 \Rightarrow \frac{x}{2} = \frac{\pi}{2} \Rightarrow x = \pi$ mathongo mathongo mathongo mathongo mathongo mathongo

$\cos x = 0 \Rightarrow x = \frac{\pi}{2}, \frac{3\pi}{2}$ mathongo mathongo mathongo mathongo mathongo mathongo

So sum = $6\pi + \pi + 2\pi = 9\pi$ mathongo mathongo mathongo mathongo mathongo mathongo

mathongo mathongo mathongo mathongo mathongo mathongo mathongo

#MathBoleTohMathonGo