

Q1. JEE Main 2026 (23 January Shift 1)

Number of solutions of $\sqrt{3} \cos 2\theta + 8 \cos \theta + 3\sqrt{3} = 0, \theta \in [-3\pi, 2\pi]$ is:

(1) 0

(2) 5

(3) 3

(4) 4

Q2. JEE Main 2026 (24 January Shift 2)

The number of elements in the set $\{x \in [0, 180^\circ] : \tan(x + 100^\circ) = \tan(x + 50^\circ) \tan x \tan(x - 50^\circ)\}$ is _____.

ANSWERS AND SOLUTIONS

1. (2)

2. 4

1. (2) Using $\cos 2\theta = 2\cos^2 \theta - 1$:

$$2\sqrt{3}\cos^2 \theta + 8\cos \theta + 2\sqrt{3} = 0 \Rightarrow \sqrt{3}\cos^2 \theta + 4\cos \theta + \sqrt{3} = 0.$$

$$\cos \theta = \frac{-4 \pm 2}{2\sqrt{3}}, \text{ giving } \cos \theta = -\frac{1}{\sqrt{3}} \text{ or } \cos \theta = -\sqrt{3} \text{ (rejected).}$$

Let $\alpha = \cos^{-1}(-1/\sqrt{3}) \approx 2.186$ rad. General solution: $\theta = 2n\pi \pm \alpha$.

In $[-3\pi, 2\pi]$: $\theta = \alpha, -\alpha, 2\pi - \alpha, -2\pi + \alpha, -2\pi - \alpha$.

Total = 5 solutions.

$$2. (4) \frac{\tan(x+100^\circ)}{\tan x} = \tan(x+50^\circ)\tan(x-50^\circ)$$

$$\frac{\sin(x+100^\circ)\cos x}{\cos(x+100^\circ)\sin x} = \frac{\sin(x+50^\circ)\sin(x-50^\circ)}{\cos(x+50^\circ)\cos(x-50^\circ)}$$

Applying Componendo & Dividendo:

$$\frac{\sin(2x+100^\circ)}{\sin 100^\circ} = \frac{\cos 100^\circ}{-\cos 2x}$$

$$2\sin(2x+100^\circ)\cos 2x + \sin 200^\circ = 0$$

$$\sin(4x+100^\circ) + \sin 100^\circ + \sin 200^\circ = 0$$

$$\sin(4x+100^\circ) = -2\sin 150^\circ \cos 50^\circ$$

$$\sin(4x+100^\circ) = -\cos 50^\circ = \sin(-40^\circ)$$

$$\therefore 4x+100^\circ = n\pi + (-1)^n(-40^\circ)$$

$$x = \frac{n\pi + (-1)^{n+1}(40^\circ) - 100^\circ}{4}$$

$$\therefore x = 30^\circ, 55^\circ, 120^\circ, 145^\circ \text{ in } (0, \pi)$$

$\therefore$ Number of solutions = 4