Topic: Trigonometric Equation

Sub: Mathematics **JEE Main Previous Year Questions** Chetan Sir

Type-1: Factorisation and Quadratic

1. The sum of all values of $\theta \in [0, 2\pi]$ satisfying $2\sin^2\theta = \cos 2\theta$ and $2\cos^2\theta = 3\sin\theta$ is **[JEE Main 2025]**

(A) 4π (B) $\frac{5\pi}{6}$ (C) π (D) $\frac{13\pi}{6}$

2. The number of solutions of the equation $\cos 2\theta \cos\frac{\theta}{2} + \cos\frac{5\theta}{2} = 2\cos^3\frac{5\theta}{2}$ in $[-\frac{\pi}{2}, \frac{\pi}{2}]$ is: **[JEE Main 2025]**

(A) 7 (B) 6 (C) 8 (D) 7

3. The number of solutions of equation $(4-\sqrt{3})\sin x - 2\sqrt{3}\cos^2 x = -\frac{4}{1+\sqrt{3}}$, $x \in [-2\pi, \frac{5\pi}{2}]$ is **[JEE Main 2025]**

(A) 4 (B) 3 (C) 6 (D) 5

4. If $\theta \in [-2\pi, 2\pi]$, then the number of solutions of $2\sqrt{2}\cos^2\theta + (2-\sqrt{6})\cos\theta - \sqrt{3} = 0$, is equal to: **[JEE Main 2025]**

(A) 12 (B) 6 (C) 8 (D) 10

5. If $\theta \in [-\frac{7\pi}{6}, \frac{4\pi}{3}]$, then the number of solutions of $\sqrt{3}\,\mathrm{cosec}^2\theta - 2(\sqrt{3}-1)\,\mathrm{cosec}\,\theta - 4 = 0$, is equal to **[JEE Main 2025]**

(A) 6 (B) 8 (C) 10 (D) 7

6. The number of elements in the set $S = \{\theta \in [0, 2\pi] : 3\cos^4\theta - 5\cos^2\theta - 2\sin^6\theta + 2 = 0\}$ is **[JEE Main 2023]**

(A) 10 (B) 8 (C) 12 (D) 9

7. Let $S = \{x \in (-\frac{\pi}{2}, \frac{\pi}{2}) : 9^{1-\tan^2 x} + 9^{\tan^2 x} = 10\}$ and $\beta = \sum_{z\in S}\tan^2(\frac{z}{3})$ then $\frac{1}{6}(\beta - 14)^2$ is equal to **[JEE Main 2023]**

(A) 16 (B) 8 (C) 64 (D) 32

8. Let $S = \{\theta \in [-\pi, \pi] - \{\pm\frac{\pi}{2}\} : \sin\theta\tan\theta + \tan\theta = \sin 2\theta\}$. If $T = \sum_{\theta\in S}\cos 2\theta$, then $T + n(S)$ is equal to **[JEE Main 2022]**

(A) $7+\sqrt{3}$ (B) 5 (C) $8+\sqrt{3}$ (D) 9

9. If the sum of solutions of the system of equations $2\sin^2\theta - \cos 2\theta = 0$ and $2\cos^2\theta + 3\sin\theta = 0$ in the interval $[0, 2\pi]$ is $k\pi$, then k is equal to **[JEE Main 2022]**

(A) 3 (B) 5 (C) 6 (D) 7

10. The number of solutions of the equation $\sin x = \cos^2 x$ in the interval (0, 10) is **[JEE Main 2022]**

(A) 4 (B) 5 (C) 6 (D) 7

11. The number of elements in the set $S = \{\theta \in [-4\pi, 4\pi] : 3\cos^2 2\theta + 6\cos 2\theta - 10\cos^2\theta + 5 = 0\}$ is **[JEE Main 2022]**

(A) 32 (B) 5 (C) 6 (D) 7

12. The number of roots of the equation, $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$ in the interval $[0, \pi]$ is equal to: **[JEE Main 2021]**

(A) 3 (B) 4 (C) 8 (D) 2

13. Let S be the sum of all solutions (in radians) of the equation $\sin^4\theta+\cos^4\theta-\sin\theta\cos\theta=0$ in $[0,4\pi]$ then $\frac{8S}{\pi}$ is equal to **[JEE Main 2021]**

(A) 56 (B) 5 (C) 6 (D) 7

14. If $\sqrt{3}(\cos^2 x)=(\sqrt{3}-1)\cos x+1$, then number of solutions of the given equation when $x\in[0,\frac{\pi}{2}]$ is **[JEE Main 2021]**

(A) 1 (B) 5 (C) 6 (D) 7

15. The sum of all values of $\theta\in(0,\frac{\pi}{2})$ satisfying $\sin^2 2\theta+\cos^4 2\theta=\frac{3}{4}$ is **[JEE Main 2019]**

(A) $\frac{\pi}{2}$ (B) $\frac{3\pi}{8}$ (C) $\frac{5\pi}{4}$ (D) π

Type-2: Problems of the form $a\sin x+b\cos x=c$

16. If $\alpha\in(-\frac{\pi}{2},\frac{\pi}{2})$ is the solution of $4\cos\theta+5\sin\theta=1$ then the value of $\tan\alpha$ is **[JEE Main 2024]**

(A) $\frac{10-\sqrt{10}}{6}$ (B) $\frac{10-\sqrt{10}}{12}$ (C) $\frac{\sqrt{10}-10}{12}$ (D) $\frac{\sqrt{10}-10}{6}$

17. Suppose $\theta\in[0,\frac{\pi}{4}]$ is a solution of $4\cos\theta-3\sin\theta=1$. Then $\cos\theta$ is equal to: **[JEE Main 2024]**

(A) $\frac{4}{(3\sqrt{6}+2)}$ (B) $\frac{6+\sqrt{6}}{(3\sqrt{6}+2)}$ (C) $\frac{4}{(3\sqrt{6}-2)}$ (D) $\frac{6-\sqrt{6}}{(3\sqrt{6}-2)}$

Type-3: Sum to Product & Product to Sum

18. If m and n respectively are the numbers of positive and negative value of θ in the interval $[-\pi,\pi]$ that satisfy the equation $\cos 2\theta\cos\frac{\theta}{2}=\cos 3\theta\cos\frac{9\theta}{2}$, then mn is equal to **[JEE Main 2023]**

(A) 25 (B) 5 (C) 6 (D) 7

19. 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: **[JEE Main 2021]**

(A) 8π (B) 11π (C) 12π (D) 9π

20. If $0\le x<\frac{\pi}{2}$ then the number of values of x for which $\sin x-\sin 2x+\sin 3x=0$, is: **[JEE Main 2019]**

(A) 4 (B) 3 (C) 2 (D) 1

Type-4: Using Range or x & y type Problem

21. The number of elements in the set $S=\{x\in\mathbb{R}:2\cos(\frac{x^2+x}{6})=4^x+4^{-x}\}$ is **[JEE Main 2022]**

(A) 1 (B) 3 (C) 0 (D) infinite

22. The number of solutions of $\sin^7 x+\cos^7 x=1$, $x\in[0,4\pi]$ is equal to **[JEE Main 2021]**

(A) 11 (B) 7 (C) 5 (D) 9

23. Let S be the set of all $\alpha\in R$ such that the equation, $\cos 2x+\alpha\sin x=2\alpha-7$ has a solution. Then S is equal to: **[JEE Main 2019]**

(A) $[3,7]$ (B) $[2,6]$ (C) $[1,4]$ (D) R

24. The number of solutions of the equation $4\sin^2 x-4\cos^3 x+9-4\cos x=0; x\in[-2\pi,2\pi]$ is: **[JEE Main 2024]**

(A) 1 (B) 3 (C) 2 (D) 0

Type-5: Graphical Problems

25. The number of solutions of the equation $2x+3\tan x=\frac{5\pi}{2}$, $x\in[-\frac{3\pi}{2},\frac{3\pi}{2}]-\{-\frac{\pi}{2},\frac{\pi}{2}\}$ is **[JEE Main 2025]**

(A) 6 (B) 5 (C) 4 (D) 3

26. The number of solutions of the equation $2\theta-\cos^2\theta+\sqrt{2}=0$ in R is equal to **[JEE Main 2022]**

(A) 1 (B) 5 (C) 6 (D) 7

27. The number of solutions of $|\cos x|=\sin x$, such that $-4\pi\le x\le 4\pi$ is **[JEE Main 2022]**

(A) 4 (B) 6 (C) 8 (D) 12

28. The number of solutions of the equation $x+2\tan x=\frac{\pi}{2}$ in the interval $[0,2\pi]$ is **[JEE Main 2021]**

(A) 3 (B) 4 (C) 2 (D) 5

Answer Key

1 (C)	**2** (A)	**3** (D)	**4** (C)	**5** (A)	**6** (D)	**7** (D)	**8** (D)	**9** (C)	**10** (D)
11 (A)	**12** (B)	**13** (A)	**14** (A)	**15** (A)	**16** (C)	**17** (C)	**18** (A)	**19** (D)	**20** (C)
21 (A)	**22** (C)	**23** (B)	**24** (D)	**25** (B)	**26** (A)	**27** (C)	**28** (A)		