Topic: Trigonometric Equation

Sub: Mathematics **MHT CET Previous Year Question** Chetan Sir

1. The common principal solution of the equations $\sin\theta = -\frac{1}{2}$ and $\tan\theta = \frac{1}{\sqrt{3}}$ is **[MHT CET 2025]**

(A) $\frac{\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{7\pi}{6}$ (D) $\frac{11\pi}{6}$

2. The principal solution of $(5+3\sin\theta)(2\cos\theta+1)=0$ are **[MHT CET 2025]**

(A) $\frac{-\pi}{3}, \frac{2\pi}{3}$ (B) $\frac{2\pi}{3}, \frac{5\pi}{3}$ (C) $\frac{2\pi}{3}, \frac{4\pi}{3}$ (D) $\frac{2\pi}{3}, \frac{7\pi}{3}$

3. The number of values of x in the interval $[0, 3\pi]$ satisfying the equation $2\sin^2 x + 5\sin x - 3 = 0$ is **[MHT CET 2025]**

(A) 6 (B) 1 (C) 2 (D) 4

4. The number of solutions of $16^{\sin^2 x} + 16^{\cos^2 x} = 10$ in $0 \le x \le 2\pi$ are **[MHT CET 2025]**

(A) 8 (B) 10 (C) 6 (D) 4

5. If $\sin(\frac{\pi}{4}\cot\theta) = \cos(\frac{\pi}{4}\tan\theta)$, then the general solution of θ is **[MHT CET 2025]**

(A) $n\pi + \frac{\pi}{4}, n \in \mathbb{Z}$ (B) $n\pi + (-1)^n \frac{\pi}{6}, n \in \mathbb{Z}$
(C) $2n\pi \pm \frac{\pi}{4}, n \in \mathbb{Z}$ (D) $2n\pi \pm 3\frac{\pi}{4}, n \in \mathbb{Z}$

6. The possible values of $\theta \in (0, \pi)$ such that $\sin\theta + \sin(4\theta) + \sin(7\theta) = 0$ are **[MHT CET 2025]**

(A) $\frac{\pi}{4}, \frac{5\pi}{12}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$ (B) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{35\pi}{36}$
(C) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{10}$ (D) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{4\pi}{9}, \frac{\pi}{2}, \frac{3\pi}{4}, \frac{8\pi}{9}$

7. If $\tan 3\theta = \cot\theta$ Then $\theta =$ **[MHT CET 2025]**

(A) $\frac{(2n+1)\pi}{8}, n \in \mathbb{Z}$ (B) $\frac{(2n+1)\pi}{4}, n \in \mathbb{Z}$
(C) $\frac{(n+2)\pi}{3}, n \in \mathbb{Z}$ (D) $n\pi, n \in \mathbb{Z}$

8. The general solutions of the equation $\tan^2\theta + \sec 2\theta = 1$ are **[MHT CET 2025]**

(A) $n\pi, n\pi \pm \frac{\pi}{3}, n \in \mathbb{Z}$ (B) $n\pi, n\pi \pm \frac{\pi}{4}, n \in \mathbb{Z}$
(C) $\frac{n\pi}{4}, \frac{n\pi}{4} \pm \frac{\pi}{3}, n \in \mathbb{Z}$ (D) $n\pi, n\pi \pm \frac{\pi}{6}, n \in \mathbb{Z}$

9. If $0 \le x \le \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$ Then x takes the value **[MHT CET 2025]**

(A) $\frac{\pi}{6}, \frac{\pi}{3}$ (B) $\frac{\pi}{3}, \frac{\pi}{4}$ (C) $\frac{5\pi}{6}, \frac{\pi}{2}$ (D) $\frac{2\pi}{3}, \frac{\pi}{4}$

10. If $\tan(\pi\cos\theta) = \cot(\pi\sin\theta)$, then $\sin(\frac{\pi}{4} + \theta) =$ **[MHT CET 2025]**

(A) $\frac{1}{2}$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2\sqrt{2}}$

11. If $1-\cos\theta = \sin\theta \cdot \sin\frac{\theta}{2}$, then the value of θ is **[MHT CET 2025]**

(A) $2n\pi, 4n\pi, n \in \mathbb{Z}$ (B) $\frac{n\pi}{2}, \frac{n\pi}{3}, n \in \mathbb{Z}$

(C) $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$ (D) $(2n-1)\frac{\pi}{4}, n \in \mathbb{Z}$

12. The number of values of x in interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is **[MHT CET 2025]**

(A) 0 (B) 5 (C) 4 (D) 6

13. The general solution of $\sin x + \cos x = 1$ is **[MHT CET 2024]**

(A) $x = 2n\pi, n \in \mathbb{Z}$ (B) $x = 2n\pi + \frac{\pi}{2}, n \in \mathbb{Z}$

(C) $x = n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{4}, n \in \mathbb{Z}$ (D) not existing

14. If for certain $x, 3\cos x \neq 2\sin x$, then the general solution of, $\sin^2 x - \cos 2x = 2 - \sin 2x$, is **[MHT CET 2024]**

(A) $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$ (B) $(2n+1)\frac{\pi}{4}, n \in \mathbb{Z}$

(C) $n\pi + (-1)^n \frac{\pi}{3}, n \in \mathbb{Z}$ (D) $\frac{n\pi}{2} + 1, n \in \mathbb{Z}$

15. Let $2\sin^2 x + 3\sin x - 2 > 0$ and $x^2 - x - 2 < 0$ (x is measured in radians). Then x lies in the interval **[MHT CET 2024]**

(A) $(\frac{\pi}{6}, \frac{5\pi}{6})$ (B) $(-1, \frac{5\pi}{6})$ (C) $(-1, 2)$ (D) $(\frac{\pi}{6}, 2)$

16. The general solution of the equation $\sqrt{3}\cos\theta + \sin\theta = \sqrt{2}$ is **[MHT CET 2024]**

(A) $n\pi + (-1)^n \frac{\pi}{2} + \frac{\pi}{6}, n \in \mathbb{Z}$ (B) $n\pi + (-1)^n \frac{\pi}{2} - \frac{\pi}{6}, n \in \mathbb{Z}$

(C) $n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{3}, n \in \mathbb{Z}$ (D) $n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{3}, n \in \mathbb{Z}$

17. Let $P = \{\theta | \sin\theta - \cos\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta | \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$ be two sets, then **[MHT CET 2024]**

(A) $P \subset Q$ and $Q - P \neq \phi$ (B) $Q \not\subset P$ (C) $P \not\subset Q$ (D) $P = Q$

18. The number of values of x in the interval $(0, 5\pi)$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ **[MHT CET 2024]**

(A) 0 (B) 5 (C) 6 (D) 10

19. The solution set of the equation $\tan x + \sec x = 2\cos x$, in the interval $[0, 2\pi]$ is **[MHT CET 2024]**

(A) $\{\frac{\pi}{6}, \frac{7\pi}{6}, \frac{3\pi}{2}\}$ (B) $\{\frac{5\pi}{6}, \frac{7\pi}{6}, \frac{3\pi}{2}\}$

(C) $\{\frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}\}$ (D) $\{\frac{5\pi}{6}, \frac{11\pi}{6}, \frac{3\pi}{2}\}$

20. The number of integral values of k for which the equation $7\cos x + 5\sin x = 2k + 1$ has a solution, is **[MHT CET 2024]**

(A) 4 (B) 8 (C) 10 (D) 12

21. Let a, b, c be three non-zero real numbers such that the equation $\sqrt{3}a\cos x + 2b\sin x = c, x \in [-\frac{\pi}{2}, \frac{\pi}{2}]$ has two distinct real roots α and β with $\alpha + \beta = \frac{\pi}{3}$. Then the value of $\frac{b}{a}$ is **[MHT CET 2024]**

(A) 0.1 (B) 0.5 (C) -0.5 (D) 1

22. The general solution of $\sin x - 3\sin 2x + \sin 3x = \cos x - 3\cos 2x + \cos 3x$ is **[MHT CET 2024]**

(A) $x = n\pi + \frac{\pi}{4}, n \in \mathbb{Z}$ (B) $x = 2n\pi + \frac{\pi}{4}, n \in \mathbb{Z}$

(C) $x = n\pi + (-1)^n \frac{\pi}{4}, n \in \mathbb{Z}$ (D) $x = \frac{n\pi}{2} + \frac{\pi}{8}, n \in \mathbb{Z}$

23. The Solution set of the equation $\sin^2\theta - \cos\theta = \frac{1}{4}$ in the interval $[0, 2\pi]$ is **[MHT CET 2024]**

(A) $\{\frac{\pi}{6}, \frac{5\pi}{6}\}$ (B) $\{\frac{\pi}{3}, \frac{5\pi}{3}\}$ (C) $\{\frac{\pi}{3}, \frac{2\pi}{3}\}$ (D) $\{\frac{2\pi}{3}, \frac{4\pi}{3}\}$

24. The number of all values of θ in the interval $(-\frac{\pi}{2}, \frac{\pi}{2})$ satisfying the equation $(1-\tan\theta)(1+\tan\theta)\sec^2\theta + 2\tan^2\theta = 0$ is **[MHT CET 2024]**

(A) 1 (B) 0 (C) 2 (D) infinitely many

25. If θ and α are not odd multiples of $\frac{\pi}{2}$ then $\tan\theta = \tan\alpha$ implies principal solution is **[MHT CET 2024]**

(A) $\theta = \alpha + \frac{n\pi}{2}, n \in \mathbb{Z}$ (B) $\theta = \alpha + \frac{3n\pi}{2}, n \in \mathbb{Z}$

(C) $\theta = n\pi + \alpha, n \in \mathbb{Z}$ (D) $\theta = \frac{n\pi}{4} + \alpha, n \in \mathbb{Z}$

26. The general solution of $2\sqrt{3}\cos^2\theta = \sin\theta$ is **[MHT CET 2024]**

(A) $n\pi + (-1)^n \frac{\pi}{3}, n \in \mathbb{Z}$ (B) $n\pi + (-1)^n \frac{\pi}{6}, n \in \mathbb{Z}$

(C) $n\pi \pm (-1)^n \frac{\pi}{4}, n \in \mathbb{Z}$ (D) $n\pi + (-1)^n \frac{2\pi}{3}, n \in \mathbb{Z}$

27. The number of solutions of $\tan x + \sec x = 2\cos x$ in $[0, 2\pi]$ are **[MHT CET 2023]**

(A) 6 (B) 4 (C) 3 (D) 2

28. If the general solution of the equation $\frac{\tan 3x - 1}{\tan 3x + 1} = \sqrt{3}$ is $x = \frac{n\pi}{p} + \frac{7\pi}{q}$ n, p, q, $\in$ Z, then $\frac{p}{q}$ is **[MHT CET 2023]**

(A) 12 (B) $\frac{1}{12}$ (C) 3 (D) 36

29. The solution set of $8\cos^2\theta + 14\cos\theta + 5 = 0$, in the interval $[0, 2\pi]$, is **[MHT CET 2023]**

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

30. The principal solutions of the equation $\sec x + \tan x = 2\cos x$ are **[MHT CET 2023]**

(A) $\frac{\pi}{6}, \frac{5\pi}{6}$ (B) $\frac{\pi}{6}, \frac{\pi}{2}$ (C) $\frac{\pi}{6}, \frac{2\pi}{3}$ (D) $\frac{\pi}{6}, \frac{\pi}{12}$

31. The solutions of $\sin x + \sin 5x = \sin 3x$ in $(0, \frac{\pi}{2})$ are **[MHT CET 2023]**

(A) $\frac{\pi}{4}, \frac{\pi}{10}$ (B) $\frac{\pi}{6}, \frac{\pi}{3}$ (C) $\frac{\pi}{4}, \frac{\pi}{12}$ (D) $\frac{\pi}{8}, \frac{\pi}{16}$

32. The general solution of the equation $3\sec^2\theta = 2\operatorname{cosec}\theta$ is **[MHT CET 2023]**

(A) $n\pi + \frac{\pi}{4}, n \in Z$ (B) $2n\pi + (-1)^n \frac{\pi}{12}, n \in Z$

(C) $n\pi + (-1)^n \frac{\pi}{6}, n \in Z$ (D) $n\pi + (-1)^n \frac{\pi}{3}, n \in Z$

33. If general solution of $\cos^2\theta - 2\sin\theta + \frac{1}{4} = 0$ is $\theta = \frac{n\pi}{A} + (-1)^n \frac{\pi}{B}$, $n \in Z$, then $A + B$ has the value **[MHT CET 2023]**

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

34. The number of possible solutions of $\sin\theta + \sin 4\theta + \sin 7\theta = 0, \theta \in (0, \pi)$ are **[MHT CET 2023]**

(A) 3 (B) 4 (C) 6 (D) 8

35. The principal solutions of $\tan 3\theta = -1$ are **[MHT CET 2022]**

(A) $\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{5\pi}{4}, \frac{19\pi}{12}, \frac{23\pi}{12}\}$ (B) $\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{\pi}{16}, \frac{19\pi}{12}, \frac{23\pi}{24}\}$

(C) $\{\frac{\pi}{4}, \frac{\pi}{12}\}$ (D) $\{\frac{\pi}{4}, \frac{\pi}{12}, \frac{13\pi}{12}, \frac{7\pi}{4}, \frac{19\pi}{4}, \frac{23\pi}{12}\}$

36. The value of θ, satisfying both the equation $\cos\theta = \frac{1}{\sqrt{2}}$ and $\tan\theta = -1$ in $[0, 2\pi]$, is **[MHT CET 2022]**

(A) $(\frac{\pi}{4})$ (B) $(\frac{5\pi}{4})$ (C) $(\frac{7\pi}{4})$ (D) $(\frac{3\pi}{4})$

37. If $3\sin\theta = 2\sin 3\theta$ and $0 < \theta < \pi$ then $\sin\theta =$ **[MHT CET 2021]**

(A) $\frac{\sqrt{2}}{\sqrt{5}}$ (B) $\frac{\sqrt{3}}{2\sqrt{2}}$ (C) $\frac{\sqrt{2}}{3}$ (D) $\frac{\sqrt{3}}{\sqrt{5}}$

38. If $2\sin(\theta+\frac{\pi}{3}) = \cos(\theta-\frac{\pi}{6})$, then $\tan\theta$ **[MHT CET 2021]**

(A) $\frac{-1}{\sqrt{3}}$ (B) $-\sqrt{3}$ (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{3}}$

39. The principal solutions of $\sqrt{3}\sec x + 2 = 0$ are **[MHT CET 2021]**

(A) $\frac{\pi}{6}, \frac{5\pi}{6}$ (B) $\frac{5\pi}{6}, \frac{7\pi}{6}$ (C) $\frac{\pi}{3}, \frac{2\pi}{3}$ (D) $\frac{2\pi}{3}, \frac{4\pi}{3}$

40. If $x \in (0, \frac{\pi}{2})$ and satisfies the equation $\sin x\cos x = \frac{1}{4}$, then the values of x are **[MHT CET 2021]**

(A) $\frac{\pi}{12}, \frac{5\pi}{12}$ (B) $\frac{\pi}{8}, \frac{3\pi}{8}$ (C) $\frac{\pi}{8}, \frac{\pi}{4}$ (D) $\frac{\pi}{6}, \frac{\pi}{12}$

41. If $3\cos x \neq 2\sin x$, then the general solution of $\sin^2 x - \cos 2x = 2 - \sin 2x$ is **[MHT CET 2020]**

(A) $x = n\pi + \frac{\pi}{2}, n \in Z$ (B) $x = (n+\frac{1}{2})\pi, n \in Z$

(C) $x = n(\frac{\pi}{2}) + \frac{\pi}{3}, n \in Z$ (D) $x = (2n+1)\pi, n \in Z$

42. If $3\sin^2 x - 8\sin x + 4 = 0, x \in (\frac{\pi}{2}, \pi)$, then $\tan x =$ **[MHT CET 2020]**

(A) $-\frac{\sqrt{5}}{2}$ (B) $\frac{2}{\sqrt{5}}$ (C) $-\frac{2}{\sqrt{5}}$ (D) $\frac{\sqrt{5}}{2}$

43. The general solution of $\frac{1-\cos 2x}{1+\cos 2x} = 3$ is **[MHT CET 2020]**

(A) $x = 2n\pi \pm \frac{\pi}{3}, n \in Z$ (B) $x = n\pi \pm \frac{\pi}{6}, n \in Z$

(C) $x = 2n\pi \pm \frac{\pi}{6}, n \in Z$ (D) $x = n\pi \pm \frac{\pi}{3}, n \in z$

44. If $2\cos^2\theta + 3\cos\theta = 2$, then permissible value of $\cos\theta$ is **[MHT CET 2020]**

(A) 0 (B) 1 (C) $\frac{1}{2}$ (D) $\frac{-1}{2}$

45. The number of solutions of $\sin x + \sin 3x + \sin 5x = 0$ in the interval $[\frac{\pi}{2}, \frac{3\pi}{2}]$ is **[MHT CET 2018]**

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

46. The general solution of the equation $\tan^2 x = 1$ is **[MHT CET 2016]**

(A) $n\pi + \frac{\pi}{4}$ (B) $n\pi - \frac{\pi}{4}$ (C) $n\pi \pm \frac{\pi}{4}$ (D) $2n\pi \pm \frac{\pi}{4}$

47. The solution of the equation $\sin 2x + \cos 2x = 0$, where $\pi < x < 2\pi$ are **[MHT CET 2016]**

(A) $\frac{7\pi}{8}, \frac{11\pi}{8}$ (B) $\frac{9\pi}{8}, \frac{13\pi}{8}$ (C) $\frac{11\pi}{8}, \frac{15\pi}{8}$ (D) $\frac{15\pi}{8}, \frac{19\pi}{8}$

Answer Key

1 (C)	**2** (C)	**3** (D)	**4** (A)	**5** (A)	**6** (D)	**7** (A)	**8** (A)	**9** (A)	**10** (D)
11 (A)	**12** (D)	**13** (C)	**14** (A)	**15** (D)	**16** (C)	**17** (D)	**18** (C)	**19** (C)	**20** (B)
21 (B)	**22** (D)	**23** (B)	**24** (C)	**25** (C)	**26** (A)	**27** (D)	**28** (B)	**29** (C)	**30** (A)
31 (B)	**32** (C)	**33** (A)	**34** (C)	**35** (A)	**36** (C)	**37** (B)	**38** (B)	**39** (B)	**40** (A)
41 (B)	**42** (C)	**43** (D)	**44** (C)	**45** (B)	**46** (C)	**47** (C)			

JEE Main Previous Year Questions

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

16. The number of solutions of the equation $1 + \sin^4 x = \cos^2 3x$, $x \in [-\frac{5\pi}{2}, \frac{5\pi}{2}]$ is: **[JEE Main 2019]**

(A) 5 (B) 7 (C) 3 (D) 4

17. Let $S = \{\theta \in [-2\pi, 2\pi] : 2\cos^2\theta + 3\sin\theta = 0\}$. Then the sum of the elements of S is: **[JEE Main 2019]**

(A) π (B) $\frac{13\pi}{6}$ (C) 0 (D) 2π

18. Let $S = \{\theta \in [0, 2\pi] : 8^{2\sin^2\theta} + 8^{2\cos^2\theta} = 16\}$. Then $n(S) + \sum_{\theta \in S}(\sec(\frac{\pi}{4} + 2\theta)\operatorname{cosec}(\frac{\pi}{4} + 2\theta))$ is equal to: **[JEE Main 2022]**

(A) 0 (B) -2 (C) -4 (D) 12

19. The number of values of x in the interval $(\frac{\pi}{4}, \frac{7\pi}{4})$ for which $14\operatorname{cosec}^2 x - 2\sin^2 x = 21 - 4\cos^2 x$ holds, is **[JEE Main 2022]**

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

20. The number of solutions of the equation $\cos(x + \frac{\pi}{3})\cos(\frac{\pi}{3} - x) = \frac{1}{4}\cos^2 2x$, $x \in [-3\pi, 3\pi]$ is: **[JEE Main 2022]**

(A) 8 (B) 5 (C) 6 (D) 7

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

21. 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) $\frac{\sqrt{10} - 10}{6}$

22. 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

23. 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

24. 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

25. 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

26. The number of solutions of $\sin^2 x + (2 + 2x - x^2)\sin x - 3(x-1)^2 = 0$, where $-\pi \le x \le \pi$, is **[JEE Main 2024]**

(A) 2 (B) 2 (C) 6 (D) 7

27. Let the set of all $a \in R$ such that the equation $\cos 2x + a\sin x = 2a - 7$ has a solution be $[p, q]$ and $r = \tan 9^\circ - \tan 27^\circ - \frac{1}{\cot 63^\circ} + \tan 81^\circ$, then pqr is equal to **[JEE Main 2022]**

(A) 48 (B) 5 (C) 6 (D) 7

28. 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

29. 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

30. All the pairs (x, y), that satisfy the inequality $2^{\sqrt{\sin^2 x-2\sin x+5}}\cdot\frac{1}{4^{\sin^2 y}}\le 1$ also satisfy the equation: **[JEE Main 2019]**

(A) $2\sin x=\sin y$ (B) $\sin x=2\sin y$ (C) $|\sin x|=|\sin y|$ (D) $2|\sin x|=3\sin y$

31. 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

32. 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

33. 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

34. 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

35. 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

36. 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

Type-6: Problems with Log or Mod

37. The number of solutions of the equation $|\cot x|=\cot x+\frac{1}{\sin x}$ in the interval $[0,2\pi]$ is **[JEE Main 2021]**

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

38. If for $x\in(0,\frac{\pi}{2})$, $\log_{10}\sin x+\log_{10}\cos x=-1$ and $\log_{10}(\sin x+\cos x)=\frac{1}{2}(\log_{10}n-1)$, $n>0$, then the value of n is: **[JEE Main 2021]**

(A) 20 (B) 12 (C) 9 (D) 16

39. The number of distinct solutions of the equation,

$$\log_{\frac{1}{2}}|\sin x|=2-\log_{\frac{1}{2}}|\cos x|$$

in the interval $[0,2\pi]$, is _____. **[JEE Main 2020]**

40. The sum of solutions of the equation $\frac{\cos x}{1+\sin x}=|\tan 2x|, x\in(-\frac{\pi}{2},\frac{\pi}{2})-\{-\frac{\pi}{4},\frac{\pi}{4}\}$ is: **[JEE Main 2021]**

(A) $\frac{\pi}{10}$ (B) $-\frac{7\pi}{30}$ (C) $-\frac{\pi}{15}$ (D) $-\frac{11\pi}{30}$

Miscellaneous

41. If for $\theta \in [-\frac{\pi}{3}, 0]$, the points $(x, y) = (3\tan(\theta + \frac{\pi}{3}), 2\tan(\theta + \frac{\pi}{6}))$ lie on $xy + \alpha x + \beta y + \gamma = 0$ then $\alpha^2 + \beta^2 + \gamma^2$ is equal to: **[JEE Main 2025]**

(A) 80 (B) 72 (C) 96 (D) 75

42. If $2\tan^2\theta - 5\sec\theta = 1$ has exactly 7 solutions in the interval $[0, \frac{n\pi}{2}]$, for the least value of $n \in N$ then $\sum_{k=1}^{n} \frac{k}{2^k}$ is equal to: **[JEE Main 2024]**

(A) $\frac{1}{2^{15}}(2^{14} - 14)$ (B) $\frac{1}{2^{14}}(2^{15} - 15)$ (C) $1 - \frac{15}{2^{13}}$ (D) $\frac{1}{2^{15}}(2^{14} - 15)$

43. If $2\sin^3 x + \sin 2x\cos x + 4\sin x - 4 = 0$ has exactly 3 solutions in the interval $[0, \frac{n\pi}{2}]$, $n \in N$, then the roots of the equation $x^2 + nx + (n-3) = 0$ belong to : **[JEE Main 2024]**

(A) $(0, \infty)$ (B) $(-\infty, 0)$ (C) $(-\frac{\sqrt{17}}{2}, \frac{\sqrt{17}}{2})$ (D) Z

44. The sum of the solutions $x \in R$ of the equation $\frac{3\cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = x^3 - x^2 + 6$ is **[JEE Main 2024]**

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

45. Let $f(\theta) = 3(\sin^4(\frac{3\pi}{2} - \theta) + \sin^4(3\pi + \theta)) - 2(1 - \sin^2 2\theta)$ and $S = \{\theta \in [0, \pi] : f'(\theta) = -\frac{\sqrt{3}}{2}\}$. If $4\beta = \sum_{\theta \in S} \theta$ then $f(\beta)$ is equal to **[JEE Main 2023]**

(A) $\frac{11}{8}$ (B) $\frac{5}{4}$ (C) $\frac{9}{8}$ (D) $\frac{3}{2}$

46. Let $S = \{\theta \in [0, 2\pi) : \tan(\pi\cos\theta) + \tan(\pi\sin\theta) = 0\}$, then $\sum_{\theta \in S} \sin^2(\theta + \frac{\pi}{4})$ is equal to **[JEE Main 2023]**

(A) 2 (B) 2 (C) 6 (D) 7

47. Let $S = \{\theta \in (0, 2\pi) : 7\cos^2\theta - 3\sin^2\theta - 2\cos^2 2\theta = 2\}$. Then, the sum of roots of all the equations $x^2 - 2(\tan^2\theta + \cot^2\theta)x + 6\sin^2\theta = 0, \theta \in S$, is **[JEE Main 2022]**

(A) 16 (B) 5 (C) 6 (D) 7

48. Let $S = [-\pi, \frac{\pi}{2}) - \{-\frac{\pi}{2}, -\frac{\pi}{4}, -\frac{3\pi}{4}, \frac{\pi}{4}\}$. Then the number of elements in the set $A = \{\theta \in S : \tan\theta(1 + \sqrt{5}\tan(2\theta)) = \sqrt{5} - \tan(2\theta)\}$ is **[JEE Main 2022]**

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

49. If $0 < x, y < \pi$ and $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$, then $\sin x + \cos y$ is equal to: **[JEE Main 2021]**

(A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1 + \sqrt{3}}{2}$ (D) $\frac{1 - \sqrt{3}}{2}$

50. If n is the number of solutions of the equation $2\cos x(4\sin(\frac{\pi}{4} + x)\sin(\frac{\pi}{4} - x) - 1) = 1$, $x \in [0, \pi]$ and S is the sum of all these solutions, then the ordered pair (n, S) is: **[JEE Main 2021]**

(A) $(3, \frac{13\pi}{9})$ (B) $(2, \frac{8\pi}{9})$ (C) $(2, \frac{2\pi}{3})$ (D) $(3, \frac{5\pi}{3})$

51. All possible values of $\theta \in [0, 2\pi]$ for which $\sin 2\theta + \tan 2\theta > 0$ lie in: **[JEE Main 2021]**

(A) $(0, \frac{\pi}{2}) \cup (\pi, \frac{3\pi}{2})$

(B) $(0, \frac{\pi}{2}) \cup (\frac{\pi}{2}, \frac{3\pi}{4}) \cup (\pi, \frac{7\pi}{6})$

(C) $(0, \frac{\pi}{4}) \cup (\frac{\pi}{2}, \frac{3\pi}{4}) \cup (\pi, \frac{5\pi}{4}) \cup (\frac{3\pi}{2}, \frac{7\pi}{4})$

(D) $(0, \frac{\pi}{4}) \cup (\frac{\pi}{2}, \frac{3\pi}{4}) \cup (\frac{3\pi}{2}, \frac{11\pi}{6})$

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** (A)	**17** (D)	**18** (C)	**19** (D)	**20** (D)
21 (C)	**22** (C)	**23** (A)	**24** (D)	**25** (C)	**26** (B)	**27** (A)	**28** (A)	**29** (C)	**30** (C)
31 (D)	**32** (B)	**33** (A)	**34** (C)	**35** (A)	**36** (A)	**37** (B)	**38** (8)	**39** (D)	**40** (D)
41 (D)	**42** (B)	**43** (C)	**44** (B)	**45** (B)	**46** (A)	**47** (A)	**48** (D)	**49** (D)	**50** (A)
51 (C)									