PrepWiser.

MATHEMATICS · JEE MAIN

Trigonometric Equations

Chapter-wise previous year questions, with answer key

33	2020–2025	2
PYQS	PAPERS	TOPICS

General Solutions · Equations Reducible to Quadratic

1. Attempt each question on paper first — they're grouped by topic, newest papers first.
2. Check yourself against the answer key at the end.
3. Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: **prepwiser.in/learn** · No signup needed to browse

General Solutions · 22 PYQs

Q1 JEE Main 2025 · 7 Apr · Shift 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 $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ is :

(A) 5

(B) 7

(C) 6

(D) 9

Step-by-step solution ▸ prepwiser.in/questions/RRwkzgPrTw

Q2 JEE Main 2025 · 2 Apr · Shift 2

If $\theta\epsilon\left[-\frac{7\pi}{6}, \frac{4\pi}{3}\right]$, then the number of solutions of $\sqrt{3}\,\mathrm{cosec}^2\theta - 2(\sqrt{3}-1)\,\mathrm{cosec}\,\theta - 4 = 0$, is equal to :

(A) 7

(B) 10

(C) 6

(D) 8

Step-by-step solution ▸ prepwiser.in/questions/Kiuhha9nMs

Q3 JEE Main 2024 · 29 Jan · Shift 2

The sum of the solutions $x \in \mathbb{R}$ of the equation $\frac{3\cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = x^3 - x^2 + 6$ is

(A) 3

(B) 1

(C) 0

(D) -1

Step-by-step solution ▸ prepwiser.in/questions/fAQ3fZqLqo

Q4 JEE Main 2024 · 27 Jan · Shift 2

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

(A) $\frac{1}{2^{14}}\left(2^{15} - 15\right)$

(B) $1 - \frac{15}{2^{13}}$

(C) $\frac{1}{2^{15}}\left(2^{14} - 14\right)$

(D) $\frac{1}{2^{13}}\left(2^{14} - 15\right)$

Step-by-step solution ▸ prepwiser.in/questions/M0kOhJ7DNl

Q5 JEE Main 2023 · 11 Apr · Shift 1

The number of elements in the set

$$S = \left\{\theta \in [0, 2\pi] : 3\cos^4\theta - 5\cos^2\theta - 2\sin^6\theta + 2 = 0\right\}$$

is :

(A) 9

(B) 8

(C) 12

(D) 10

Step-by-step solution ▸ prepwiser.in/questions/HjQpDag5Ko

Q6 JEE Main 2023 · 25 Jan · Shift 2

If m and n respectively are the numbers of positive and negative values 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 _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/y3GP43A5la

Q7 JEE Main 2023 · 24 Jan · Shift 2

Let

$$S = \{\theta \in [0, 2\pi) : \tan(\pi\cos\theta) + \tan(\pi\sin\theta) = 0\}$$

. Then

$$\sum_{\theta \in S} \sin^2\left(\theta + \frac{\pi}{4}\right)$$

is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/zB_qSWSlXt

Q8 JEE Main 2022 · 28 Jul · Shift 2

Let

$$S = \left[-\pi, \frac{\pi}{2}\right) - \left\{-\frac{\pi}{2}, -\frac{\pi}{4}, -\frac{3\pi}{4}, \frac{\pi}{4}\right\}$$

. 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 _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/9MKlzMoag1

Q9 JEE Main 2022 · 27 Jul · Shift 2

Let

$$S = \left\{\theta \in \left(0, \frac{\pi}{2}\right) : \sum_{m=1}^{9} \sec\left(\theta + (m-1)\frac{\pi}{6}\right)\sec\left(\theta + \frac{m\pi}{6}\right) = -\frac{8}{\sqrt{3}}\right\}$$

. Then

(A) $S = \left\{\frac{\pi}{12}\right\}$

(B) $S = \left\{\frac{2\pi}{3}\right\}$

(C) $\sum\limits_{\theta \in S} \theta = \frac{\pi}{2}$

(D) $\sum\limits_{\theta \in S} \theta = \frac{3\pi}{4}$

Step-by-step solution ▸ prepwiser.in/questions/aw6Gu4C6tC

Q10 JEE Main 2022 · 26 Jul · Shift 1

Let

$$S = \left\{\theta \in [0, 2\pi] : 8^{2\sin^2\theta} + 8^{2\cos^2\theta} = 16\right\}.$$

Then

$$n(s) + \sum_{\theta \in S}\left(\sec\left(\frac{\pi}{4} + 2\theta\right)\operatorname{cosec}\left(\frac{\pi}{4} + 2\theta\right)\right)$$

is equal to:

(A) 0

(B) -2

(C) -4

(D) 12

Step-by-step solution ▸ prepwiser.in/questions/EhcMnblAm5

Q11 JEE Main 2022 · 26 Jul · Shift 2

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 _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/kX8yliE3-7

Q12 JEE Main 2022 · 30 Jun · Shift 1

Let $S_1 = \{x \in [0, 12\pi] : \sin^5 x + \cos^5 x = 1\}$

and $S_2 = \{x \in [0, 8\pi] : \sin^7 x + \cos^7 x = 1\}$

Then $n(S_1) - n(S_2)$ is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/ZBG_Bn73aY

Q13 JEE Main 2022 · 29 Jun · Shift 1

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 _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/-awNhEycy8

Q14 JEE Main 2022 · 24 Jun · Shift 2

The number of solutions of the equation

$$\cos\left(x + \frac{\pi}{3}\right)\cos\left(\frac{\pi}{3} - x\right) = \frac{1}{4}\cos^2 2x$$

, $x \in [-3\pi, 3\pi]$ is :

(A) 8

(B) 5

(C) 6

(D) 7

Step-by-step solution ▸ prepwiser.in/questions/ro4vgAXl9W

Q15 JEE Main 2022 · 24 Jun · Shift 1

Let

$$S = \left\{\theta \in [-\pi, \pi] - \left\{\pm \frac{\pi}{2}\right\} : \sin\theta \tan\theta + \tan\theta = \sin 2\theta\right\}$$

.

If $T = \sum_{\theta \in S} \cos 2\theta$, then T + n(S) is equal to :

(A) 7 + $\sqrt{3}$

(B) 9

(C) 8 + $\sqrt{3}$

(D) 10

Step-by-step solution ▸ prepwiser.in/questions/jYk9FzyIZi

Q16 JEE Main 2021 · 26 Aug · Shift 1

The sum of solutions of the equation

$\frac{\cos x}{1+\sin x} = |\tan 2x|$,

$$x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) - \left\{\frac{\pi}{4}, -\frac{\pi}{4}\right\}$$

is :

(A) $-\frac{11\pi}{30}$

(B) $\frac{\pi}{10}$

(C) $-\frac{7\pi}{30}$

(D) $-\frac{\pi}{15}$

Step-by-step solution ▸ prepwiser.in/questions/oN2dHJo1-j

Q17 JEE Main 2021 · 25 Jul · Shift 2

The number of distinct real roots

of

$$\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$$

in the interval $-\frac{\pi}{4} \le x \le \frac{\pi}{4}$ is :

(A) 4

(B) 1

(C) 2

(D) 3

Step-by-step solution ▸ prepwiser.in/questions/VUImXna7eA

Q18 JEE Main 2021 · 25 Jul · Shift 1

The sum of all values of x in [0, 2π], for which sin x + sin 2x + sin 3x + sin 4x = 0, is equal to :

(A) 8π

(B) 11π

(C) 12π

(D) 9π

Step-by-step solution ▸ prepwiser.in/questions/kLh1hxn255

Q19 JEE Main 2021 · 22 Jul · Shift 2

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

(A) 11 **(B)** 7

(C) 5 **(D)** 9

Step-by-step solution ▸ prepwiser.in/questions/hU0ugvPCeX

Q20 JEE Main 2021 · 18 Mar · Shift 1

The number of solutions of the equation

$|\cot x| = \cot x + \frac{1}{\sin x}$ in the interval [0, 2π] is

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/yDppOqKQzS

Q21 JEE Main 2021 · 25 Feb · Shift 1

All possible values of $\theta \in [0, 2\pi]$ for which $\sin 2\theta + \tan 2\theta > 0$ lie in :

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

(B) $\left(0, \frac{\pi}{2}\right) \cup \left(\pi, \frac{3\pi}{2}\right)$

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

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

Step-by-step solution ▸ prepwiser.in/questions/L8zcik63w0

Q22 JEE Main 2020 · 7 Jan · Shift 2

If θ_1 and θ_2 be respectively the smallest and the largest values of θ in $(0, 2\pi) - \{\pi\}$ which satisfy the equation,

$2\cot^2\theta - \frac{5}{\sin\theta} + 4 = 0$, then

$\int_{\theta_1}^{\theta_2} \cos^2 3\theta \, d\theta$ is equal to :

(A) $\frac{\pi}{9}$ **(B)** $\frac{2\pi}{3}$

(C) $\frac{\pi}{3}$ **(D)** $\frac{\pi}{3} + \frac{1}{6}$

Step-by-step solution ▸ prepwiser.in/questions/HP-0dSvvqS

Equations Reducible to Quadratic · 11 PYQs

Q23 JEE Main 2025 · 3 Apr · Shift 2

The number of solutions of the equation
$(4-\sqrt{3})\sin x - 2\sqrt{3}\cos^2 x = -\frac{4}{1+\sqrt{3}}, x \in \left[-2\pi, \frac{5\pi}{2}\right]$ is

(A) 4 **(B)** 3

(C) 6 **(D)** 5

Step-by-step solution ▸ prepwiser.in/questions/-hDaxPWxj9

Q24 JEE Main 2025 · 2 Apr · Shift 1

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:

(A) 8 **(B)** 6

(C) 10 **(D)** 12

Step-by-step solution ▸ prepwiser.in/questions/Qx539exPYT

Q25 JEE Main 2025 · 22 Jan · Shift 2

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

(A) π **(B)** $\frac{5\pi}{6}$

(C) $\frac{\pi}{2}$ **(D)** 4π

Step-by-step solution ▸ prepwiser.in/questions/IsrMiWgsps

Q26 JEE Main 2024 · 1 Feb · Shift 2

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 :

(A) 0 **(B)** 3

(C) 1 **(D)** 2

Step-by-step solution ▸ prepwiser.in/questions/oFqJrkpwrl

Q27 JEE Main 2023 · 10 Apr · Shift 2

Let

$$S = \left\{x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) : 9^{1-\tan^2 x} + 9^{\tan^2 x} = 10\right\}$$

and $\beta = \sum_{x \in S} \tan^2\left(\frac{x}{3}\right)$, then $\frac{1}{6}(\beta - 14)^2$ is equal to :

(A) 16 **(B)** 32

(C) 8 **(D)** 64

Step-by-step solution ▸ prepwiser.in/questions/zwHIWDyGxl

Q28 JEE Main 2022 · 29 Jul · Shift 1

Let

$$S = \left\{\theta \in (0, 2\pi) : 7\cos^2\theta - 3\sin^2\theta - 2\cos^2 2\theta = 2\right\}$$

. Then, the sum of roots of all the equations

$$x^2 - 2\left(\tan^2\theta + \cot^2\theta\right)x + 6\sin^2\theta = 0, \theta \in S$$

, is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/x1QI6qpHJV

Q29 JEE Main 2021 · 31 Aug · Shift 2

The number of solutions of the equation $32^{\tan^2 x} + 32^{\sec^2 x} = 81,\ 0 \le x \le \frac{\pi}{4}$ is :

(A) 3 **(B)** 1

(C) 0 **(D)** 2

Step-by-step solution ▸ prepwiser.in/questions/FMYwia26kN

Q30 JEE Main 2021 · 27 Aug · Shift 2

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, 4π]. Then $\frac{8S}{\pi}$ is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/0CbCmp1c2s

Q31 JEE Main 2021 · 16 Mar · Shift 1

The number of roots of the equation, $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$ in the interval [0, π] is equal to :

(A) 2 **(B)** 3

(C) 4 **(D)** 8

Step-by-step solution ▸ prepwiser.in/questions/kvu-0P5JMi

Q32 JEE Main 2021 · 26 Feb · Shift 1

If $\sqrt{3}(\cos^2 x) = (\sqrt{3} - 1)\cos x + 1$, the number of solutions of the given equation when $x \in \left[0, \frac{\pi}{2}\right]$ is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/ZCB1jcVS64

Q33 JEE Main 2020 · 7 Jan · Shift 1

Let α and β be two real roots of the equation

(k + 1)$\tan^2$x - $\sqrt{2}$. λtanx = (1 - k), where k($\neq$ - 1) and λ are real numbers. if $\tan^2(\alpha + \beta)$ = 50, then a value of λ is:

(A) $5\sqrt{2}$ **(B)** 10

(C) 5 **(D)** $10\sqrt{2}$

Step-by-step solution ▸ prepwiser.in/questions/F9EVAP-Q_

Answer key — Trigonometric Equations

Numbers match the question numbers above. For full working, open the solution link under each question.

1 **B**	2 **C**	3 **D**	4 **D**	5 **A**	6 **25**	7 **2**	8 **5**
9 **C**	10 **C**	11 **3**	12 **4**	13 **32**	14 **D**	15 **B**	16 **A**
17 **B**	18 **D**	19 **C**	20 **1**	21 **D**	22 **C**	23 **D**	24 **A**
25 **A**	26 **A**	27 **B**	28 **16**	29 **B**	30 **56**	31 **C**	32 **1**
33 **B**							