JEE MAIN + ADVANCED

MATHEMATICS

TOPIC NAME

TRIGONOMETRIC EQUATION

(PRACTICE SHEET)

LEVEL - 1

Question based on **General solution of standard Trigonometrical Equation**

Q.1 The general solution of $\tan\left(\frac{2}{3}\theta\right) = \sqrt{3}$ is –

(A) $\frac{3n\pi}{2} + \frac{\pi}{2}$; $n \in I$ (B) $\frac{n\pi}{2}; \pm\frac{\pi}{2} n \in I$

(C) $n\pi \pm \frac{\pi}{2}$; $n \in I$ (D) None of these

Q.2 If $\tan\theta + \tan 2\theta + \tan\theta \tan 2\theta = 1$ then general value of θ is –

(A) $n\pi$; $n \in I$ (B) $n\pi \pm \frac{\pi}{3}$; $n \in I$

(C) $\frac{n\pi}{3} + \frac{\pi}{12}$; $n \in I$ (D) none of these

Q.3 Find the general value of θ, when $\sec\theta = \frac{2}{\sqrt{3}}$

(A) $n\pi + \frac{\pi}{6}$ (B) $n\pi - \frac{\pi}{6}$

(C) $2n\pi \pm \frac{\pi}{6}$ (D) $n\pi + (-1)^n \frac{\pi}{6}$

Q.4 Find the general value of θ, when $\cos\left(\frac{-\theta}{2}\right) = 0$

(A) $(n + 1)\pi$; $n \in I$ (B) $n\pi$; $n \in I$

(C) $(2n + 1)\pi$; $n \in I$ (D) $2n\pi$; $n \in I$

Q.5 If $\tan a\theta - \tan b\theta = 0$, then the values of θ for a series in –

(A) A.P. (B) G.P.

(C) H.P. (D) None of these

Q.6 Find the general solution of $2\sin x + \tan x = 0$

(A) $n\pi, (3k \pm 1)\frac{2\pi}{3}$; $k \in I$

(B) $2n\pi, (3k + 1)\frac{2\pi}{3}$; $k \in I$

(C) $2n\pi, (3k \pm 1)\frac{2\pi}{3}$; $k \in I$

(D) None of these

Q.7 The solution set of $(2\cos x - 1)(3 + 2\cos x) = 0$ in the interval $0 \le x \le 2\pi$ is-

(A) $\{\pi/3\}$

(B) $\{\pi/3, 5\pi/3\}$

(C) $\{\pi/3, 5\pi/3, \cos^{-1}(-3/2)\}$

(D) None of these

Q.8 The general solution of the equation $\tan^2\theta + 2\sqrt{3}\tan\theta = 1$ is given by -

(A) $\theta = \frac{\pi}{2}$ (B) $\left(n + \frac{1}{2}\right)\pi$

(C) $(6n + 1)\frac{\pi}{12}$ (D) $\frac{n\pi}{12}$

Q.9 If $\cos\theta + \cos 7\theta + \cos 3\theta + \cos 5\theta = 0$, then θ =

(A) $\frac{n\pi}{4}$; $n \in I$ (B) $\frac{n\pi}{2}$; $n \in I$

(C) $\frac{n\pi}{8}$; $n \in I$; $n \neq 8k$ (D) $\frac{n\pi}{3}$; $n \in I$

Q.10 The value of θ satisfying $\sin 7\theta = \sin 4\theta - \sin\theta$ and $0 < \theta < \pi/2$ are -

(A) $\frac{\pi}{9}, \frac{\pi}{4}$ (B) $\frac{\pi}{3}, \frac{\pi}{9}$

(C) $\frac{\pi}{6}, \frac{\pi}{9}$ (D) $\frac{\pi}{3}, \frac{\pi}{4}$

Q.11 The general solution of equation $\sin^2\theta \sec\theta + \sqrt{3}\tan\theta = 0$ is-

(A) $\theta = n\pi + (-1)^{n+1}\frac{\pi}{3}$ (B) $\theta = n\pi$

(C) $\theta = n\pi + (-1)^{n+1}\frac{\pi}{6}$ (D) $\theta = \frac{n\pi}{2}$

Q.12 If $(1 + \tan\theta)(1 + \tan\phi) = 2$, then $\theta + \phi$ =

(A) 30^o (B) 45^o

(C) 60^o (D) 75^o

Q.13 If α is a root of $25\cos^2\theta + 5\cos\theta - 12 = 0$, $\frac{\pi}{2} < \alpha < \pi$, then $\sin 2\alpha$ is equal to-

(A) $\frac{24}{25}$ (B) $-\frac{24}{25}$ (C) $\frac{13}{18}$ (D) $-\frac{13}{18}$

Q.14 The general solution of the equation $\cos x + \sec x = 2$ is given by-

(A) $2n\pi$; $n \in I$ (B) $n\pi$; $n \in I$

(C) $\frac{n\pi}{4}$; $n \in I$ (D) $\frac{n\pi}{2}$; $n \in I$

Q.15 The general solution of $\sin x + 3 \sin 2x + \sin 3x = \cos x + 3 \cos 2x + \cos 3x$ then in the interval $0 \le x \le 2\pi$, x =

(A) $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{2\pi}{3}$

(B) $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8}$

(C) $\frac{4\pi}{3}, \frac{9\pi}{3}, \frac{2\pi}{3}, \frac{13\pi}{8}$

(D) $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{3}, \frac{4\pi}{3}$

Q.16 The solution set of the equation $4\sin\theta \cos\theta - 2\cos\theta - 2\sqrt{3}\sin\theta + \sqrt{3} = 0$ in the interval $(0, 2\pi)$ is-

(A) $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}\right\}$ (B) $\left\{\frac{\pi}{3}, \frac{5\pi}{3}\right\}$

(C) $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}, \frac{\pi}{3}, \frac{5\pi}{3}\right\}$ (D) $\left\{\frac{\pi}{6}, \frac{5\pi}{6}, \frac{11\pi}{6}\right\}$

Q.17 The general value of θ satisfying the equation $\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0$

(A) $2n\pi \pm \frac{\pi}{3}$ (B) $2n\pi \pm \frac{\pi}{4}$

(C) $2n\pi \pm \frac{\pi}{6}$ (D) None of these

Q.18 If $\tan\theta + \tan 4\theta + \tan 7\theta = \tan\theta \tan 4\theta \tan 7\theta$, then θ =

(A) $\frac{n\pi}{4}$ (B) $\frac{n\pi}{7}$

(C) $\frac{n\pi}{12}$; $n \ne 6(2k + 1)$ (D) $n\pi$

Question based on **General solution of square of Trigonometric Equation**

Q.19 If $2\tan^2\theta = \sec^2\theta$, then the general value of θ is

(A) $n\pi + \frac{\pi}{4}$; $n \in I$ (B) $n\pi - \frac{\pi}{4}$; $n \in I$

(C) $n\pi \pm \frac{\pi}{4}$; $n \in I$ (D) $2n\pi \pm \frac{\pi}{4}$; $n \in I$

Q.20 If $3(\sec^2\theta + \tan^2\theta) = 5$, then the general value of θ is -

(A) $2n\pi + \frac{\pi}{6}$ (B) $2n\pi \pm \frac{\pi}{6}$

(C) $n\pi \pm \frac{\pi}{6}$ (D) $n\pi \pm \frac{\pi}{3}$

Q.21 If $2\cot^2\theta = \operatorname{cosec}^2\theta$, then the general value of θ is-

(A) $n\pi \pm \frac{\pi}{4}$ (B) $2n\pi \pm \frac{\pi}{4}$

(C) $n\pi + (-1)^n \frac{\pi}{4}$ (D) $2n\pi \pm \frac{\pi}{2}$

Question based on **General solution of Trigonometric Equation $a\cos\theta + b\sin\theta = c$**

Q.22 The equation $a\sin x + b\cos x = c$, where $|c| > \sqrt{a^2 + b^2}$ has -

(A) A unique solution

(B) Infinite no. of solutions

(C) No solution

(D) None of these

Q. 23 General solution of $\sin^3 x + \cos^3 x + \frac{3}{2}\sin 2x = 1$

(A) $x = n\pi$ when n is even integer

(B) $x = n\pi + \frac{\pi}{2}$ when n is odd integer

(C) $x = 2n\pi$ when n is odd integer

(D) $x = n\pi - \frac{\pi}{2}$ when n is even integer

Question based on **Most General Value**

Q.24 The most general value of θ which satisfies both the equations $\tan\theta = \sqrt{3}$ and $\operatorname{cosec}\theta = -\frac{2}{\sqrt{3}}$ is

(A) $n\pi + \frac{4\pi}{3}$; $n \in I$ (B) $n\pi + \frac{2\pi}{3}$; $n \in I$

(C) $2n\pi + \frac{4\pi}{3}$: $n \in I$ (D) $2n\pi + \frac{2\pi}{3}$; $n \in I$

LEVEL- 2

Q.1 The general solutions of the equation $\sec^2 x = \sqrt{2}\ (1 - \tan^2 x)$ are given by-

(A) $n\pi + \frac{\pi}{8}$ (B) $n\pi \pm \frac{\pi}{4}$

(C) $n\pi \pm \frac{\pi}{8}$ (D) None of these

Q.2 The general solution of the equation $7\cos^2 x + \sin x \cos x - 3 = 0$ is given by-

(A) $n\pi + \frac{\pi}{2}$ $(n \in I)$

(B) $n\pi - \frac{\pi}{4}$ $(n \in I)$

(C) $n\pi + \tan^{-1}\frac{4}{3}$ $(n \in I)$

(D) $n\pi - \frac{\pi}{4}, k\pi + \tan^{-1}\frac{4}{3}$ $(n, k \in I)$

Q.3 Find the general solution of x, $\cos^2 2x + \cos^2 3x = 1$

(A) $(2k + 1)\frac{\pi}{10},\ k \in I$

(B) $(\pi k + 1)\frac{\pi}{10};\ k \in I$

(C) $(2k - 1)\frac{\pi}{10},\ k \in I$

(D) Both (A) and (C)

Q.4 The set of values of x for which $\sin x \cdot \cos^3 x > \cos x \cdot \sin^3 x$, $0 \le x \le 2\pi$, is-

(A) $(0, \pi)$ (B) $\left(0, \frac{\pi}{4}\right)$

(C) $\left(\frac{\pi}{4}, \pi\right)$ (D) None of these

Q.5 The general solution of the equation $(\sqrt{3} - 1)\sin\theta + (\sqrt{3} + 1)\cos\theta = 2$ is -

(A) $2n\pi \pm \frac{\pi}{4} + \frac{\pi}{12}$

(B) $n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{12}$

(C) $2n\pi \pm \frac{\pi}{4} - \frac{\pi}{12}$

(D) $n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{12}$

Q.6 If $0 \le x \le 2\pi$, $0 \le y \le 2\pi$ and $\sin x + \sin y = 2$ then the value of $x + y$ is-

(A) π (B) $\pi/2$

(C) 3π (D) None of these

Q.7 If $x \in \left[-\frac{5\pi}{2}, \frac{5\pi}{2}\right]$, the greatest positive solution of $1 + \sin^4 x = \cos^2 3x$ is-

(A) π (B) 2π

(C) $5\pi/2$ (D) None of these

Q.8 If $\cos x = \sqrt{1 - \sin 2x}$, $0 < x < \pi$, then a value of x is-

(A) $\tan^{-1} 2$ (B) 0

(C) π (D) None of these

Q.9 The number of values of x in $[0, 5\pi]$ satisfying the equation $3\cos 2x - 10\cos x + 7 = 0$ are-

(A) 5 (B) 6 (C) 8 (D) 10

Q.10 Total number of solution of $16^{\cos^2 x} + 16^{\sin^2 x} = 10$ in $x \in [0, 3\pi]$ is equal to-

(A) 4 (B) 8

(C) 12 (D) 16

LEVEL- 3

Q.1 The solution of the equation
$\log_2(\sin x + \cos x) - \log_2(\cos x) + 1 = 0$:

(A) $\tan^{-1}\left(-\frac{1}{2}\right)$ (B) 0

(C) $\tan^{-1}\left(\frac{1}{2}\right)$ (D) None of these

Q.2 The set of solution satisfying inequality
$|\sin x| < \frac{1}{2}$ is-

(A) $\left(n\pi, n\pi + \frac{\pi}{6}\right)(n \in I)$

(B) $\left(2n\pi, 2n\pi + \frac{\pi}{6}\right)$

(C) $\left(n\pi + \frac{\pi}{6}, n\pi + \frac{5\pi}{6}\right)$

(D) None of these

Q.3 The solution of equation
$13 - 4\cos^2 x = 12 \sin x$ is -

(A) $n\pi + (-1)^n \sin^{-1}\left(\frac{3}{2}\right)$

(B) $n\pi + (-1)^n \sin^{-1}\left(-\frac{3}{2}\right)$

(C) $n\pi$

(D) No solution

Q.4 The solution set of equation
$\cos^5 x = 1 + \sin^4 x$ is-

(A) $n\pi$ $(n \in I)$ (B) $2n\pi$ $(n \in I)$

(C) $4n\pi$ $(n \in I)$ (D) None of these

Q.5 The number of ordered pairs (x, y) satisfying $y = 2\sin x$ and $y = 5x^2 + 2x + 3$ is -

(A) 0 (B) 1 (C) 2 (D) ∞

Q.6 If $0 \le x \le 3\pi$, $0 \le y \le 3\pi$ and $\cos x \cdot \sin y = 1$ then the possible number of values of the ordered pair (x, y) is -

(A) 6 (B) 12 (C) 8 (D) 15

Q.7 The most general values of x for which
$\sin x + \cos x = \min_{a \in R} \{1, a^2 - 4a + 6\}$ are given by -

(A) $2n\pi$

(B) $2n\pi + \frac{\pi}{2}$

(C) $n\pi + (-1)^n \cdot \frac{\pi}{4} - \frac{\pi}{4}$

(D) None of these

Q.8 The number of distinct solutions of
$\sin 5\theta \cdot \cos 3\theta = \sin 9\theta \cdot \cos 7\theta$ in $[0, \pi/2]$ is-

(A) 4 (B) 5 (C) 8 (D) 9

Q.9 The values of $x \in [-2\pi, 2\pi]$ such that
$\frac{\sin x + i \cos x}{1 + i}$, $i = \sqrt{-1}$, is purely imaginary, are given by -

(A) $n\pi - \frac{\pi}{4}$ (B) $n\pi + \frac{\pi}{4}$

(C) $n\pi$ (D) None of these

Q.10 The general solution of the equation
$\tan 2\theta \cdot \tan\theta = 1$ for $n \in I$ is, θ is equal to-

(A) $(2n + 1)\frac{\pi}{4}$ (B) $(2n + 1)\frac{\pi}{6}$

(C) $(2n + 1)\frac{\pi}{2}$ (D) $(2n + 1)\frac{\pi}{3}$

Q.11 Number of ordered pairs (a, x) satisfying the equation $\sec^2(a + 2)x + a^2 - 1 = 0; -\pi < x < \pi$ is-

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

Q.12 The general solution of the equation
$\sin^{50} x - \cos^{50} x = 1$ is-

(A) $2n\pi + \frac{\pi}{2}$ (B) $2n\pi + \frac{\pi}{3}$

(C) $n\pi + \frac{\pi}{2}$ (D) $n\pi + \frac{\pi}{3}$

Q.13 For any real value of $\theta \neq \pi$, the value of the expression $y = \frac{\cos^2\theta - 1}{\cos^2\theta + \cos\theta}$ is-

(A) $1 \le y \le 2$ (B) $y < 0$ and $y > 2$

(C) $-1 \le y \le 1$ (D) $y \ge 1$

Q.14 Total number of integral values of 'n' so that $\sin x (\sin x + \cos x) = n$ has at least one solution is-

(A) 2 (B) 1

(C) 3 (D) Zero

Q.15 If $r > 0$, $-\pi \le \theta \le \pi$ and r, θ satisfy $r\sin\theta = 3$ and $r = 4(1 + \sin\theta)$, then the number of possible solutions of the pair (r, θ) is-

(A) 2 (B) 4

(C) 0 (D) Infinite

Q.16 The value of θ satisfying

$3\cos^2\theta - 2\sqrt{3}\sin\theta\cos\theta - 3\sin^2\theta = 0$ are-

(A) $n\pi - \frac{2\pi}{3}, n\pi + \frac{\pi}{6}$ (B) $n\pi - \frac{\pi}{3}, n\pi + \frac{\pi}{6}$

(C) $2n\pi - \frac{\pi}{3}, n\pi$ (D) $2n\pi + \frac{\pi}{3}, n\pi$

Statement type Questions

Each of the questions given below consists of Statement – I and Statement – II. Use the following Key to choose the appropriate answer.

(A) If both Statement- I and Statement- II are be true, and Statement-II is the correct explanation of Statement– I.

(B) If both Statement - I and Statement - II are true but Statement - II is not the correct explanation of Statement – I.

(C) If Statement - I is true but Statement - II is false.

(D) If Statement - I is false but Statement - II is true.

Q.17 **Statement I :** If $\cos\theta = -\frac{1}{2}$ then general solution for θ is $2n\pi \pm \frac{\pi}{6}$.

Statement II : If $\cos\theta = \cos\alpha$, then $\theta = 2n\pi \pm \alpha$

Q.18 **Statement I:** If $\tan m\theta + \cot n\theta = 0$ then general value of $\theta = \frac{(2r+1)\pi}{2(m-n)}$ where $r \in I$.

Statement II : If $\tan\theta = \cot\alpha \ \therefore \ \theta = r\pi + \alpha$

Q.19 **Statement I:** $\cot\theta - \tan\theta = 2$, then $\theta = (4n + 1)\frac{\pi}{8}$

Statement II : $\sin 2x + \cos 2x + \sin x + \cos x + 1 = 0$ has no solution in the I^{st} quadrant.

LEVEL- 4

(Question asked in previous AIEEE and IIT-JEE)

SECTION –A

Q.1 Find the no. of roots of the equation $\tan x + \sec x = 2\cos x$ in the interval $[0, 2\pi]$- **[AIEEE-2002]**

(A) 1 (B) 2

(C) 3 (D) 4

Q.2 General solution of $\tan 5\theta = \cot 2\theta$ is- **[AIEEE-2002]**

(A) $\theta = \frac{n\pi}{7} + \frac{\pi}{14}$ (B) $\theta = \frac{n\pi}{7} + \frac{\pi}{5}$

(C) $\theta = \frac{n\pi}{7} + \frac{\pi}{2}$ (D) None of these

Q.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 – **[AIEEE-2006]**

(A) 6 (B) 1

(C) 2 (D) 4

Q.4 If $0 < x < \pi$, and $\cos x + \sin x = \frac{1}{2}$,

then $\tan x$ is – **[AIEEE-2006]**

(A) $(4 - \sqrt{7})/3$ (B) $-(4 + \sqrt{7})/3$

(C) $(1 + \sqrt{7})/4$ (D) $(1 - \sqrt{7})/4$

Q.5 The possible values of $\theta \in (0, \pi)$ such that $\sin(\theta) + \sin(4\theta) + \sin(7\theta) = 0$ are – **[AIEEE-2011]**

(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) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$

(D) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{4\pi}{9}, \frac{\pi}{2}, \frac{3\pi}{4}, \frac{8\pi}{9}$

SECTION-B

Q.1 The number of solutions of the equation $\tan x + \sec x = 2\cos x$ lying in the interval $[0, 2\pi]$ is **[IIT-1993]**

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

Q.2 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- **[IIT-1994]**

(A) $\left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$ (B) $\left(-1, \frac{5\pi}{6}\right)$

(C) $(-1, 2)$ (D) $\left(\frac{\pi}{6}, 2\right)$

Q.3 The number of all possible triplets (a_1, a_2, a_3) such that $a_1 + a_2\cos 2x + a_3\sin^2 x = 0$ for all x is- **[IIT-1994]**

(A) 0 (B) 1

(C) 2 (D) infinite

Q.4 The smallest positive root of the equation $\tan x - x = 0$ lies on- **[IIT-1994]**

(A) $\left(0, \frac{\pi}{2}\right)$

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

(C) $\left(\pi, \frac{3\pi}{2}\right)$

(D) $\left(\frac{3\pi}{2}, 2\pi\right)$

Q.5 General value of θ satisfying equation $\tan^2\theta + \sec 2\theta = 1$ is- **[IIT-1996]**

(A) $n\pi$ (B) $n\pi + \frac{\pi}{3}$

(C) $n\pi - \frac{\pi}{3}$ (D) all of these

Q.6 The solution set of the system of equations: $x + y = \frac{2\pi}{3}$, $\cos x + \cos y = \frac{3}{2}$, where x & y are real in: **[IIT-1998]**

(A) a finite non-empty set

(B) null set

(C) ∞

(D) none of these

Q.7 The number of values of x in the interval $[0, 5\pi]$ satisfying the equation

$3\sin^2 x - 7\sin x + 2 = 0$ is- **[IIT-1998]**

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

Q.8 The number of integral values of k for which the equation $7\cos x + 5\sin x = 2k + 1$ has a solution is- **[IIT-2002]**

(A) 4 (B) 8

(C) 10 (D) 12

Q.9 For which interval for θ, the inequation $(2\sin^2\theta - 5\sin\theta + 2) > 0$. When $0 < \theta < 2\pi$ **[IIT-2006]**

(A) $\left(\frac{13\pi}{48}, 2\pi\right)$ (B) $\left(0, \frac{\pi}{8}\right) \cup \left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$

(C) $\left(\frac{\pi}{8}, \frac{5\pi}{6}\right)$ (D) $\left(0, \frac{\pi}{6}\right) \cup \left(\frac{5\pi}{6}, 2\pi\right)$

Q.10 The number of solutions of the pair of equations $2\sin^2\theta - \cos 2\theta = 0$, $2\cos^2\theta - 3\sin\theta = 0$ in the interval $[0, 2\pi]$ is- **[IIT-2007]**

(A) zero (B) one

(C) two (D) four

Numerical Response Question:

Q.11 The number of values of θ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ such that $\theta \neq \frac{n\pi}{5}$ for $n = 0, \pm1, \pm 2$ and $\tan\theta = \cot 5\theta$ as well as $\sin 2\theta = \cos 4\theta$ is…… **[IIT-2010]**

Q.12 The positive integer value of $n > 3$ satisfying the equation

$$\frac{1}{\sin\left(\frac{\pi}{n}\right)} = \frac{1}{\sin\left(\frac{2\pi}{n}\right)} + \frac{1}{\sin\left(\frac{3\pi}{n}\right)}$$ is. **[IIT-2011]**

ANSWER KEY

LEVEL-1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	A	D	C	C	A	A	B	C	C	A	B	B	B	A
Q.No.	15	16	17	18	19	20	21	22	23	24				
Ans.	B	D	A	C	C	C	A	C	A	C				

LEVEL-2

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	C	D	D	B	A	A	B	A	C	C

LEVEL-3

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	A	D	D	B	A	A	C	D	A	B	C	C	B	A	A
Q.No.	16	17	18	19											
Ans.	B	D	C	B											

LEVEL-4

SECTION-A

Q.No.	1	2	3	4	5
Ans.	B	D	D	B	D

SECTION-B

1.[C] $\tan x + \sec x = 2 \cos x$

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

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

$\sin x + 1 = 2 - 2 \sin^2 x$

$2 \sin^2 x + \sin x - 1 = 0$

$2 \sin^2 x + 2 \sin x - \sin x - 1 = 0$

$2 \sin x (\sin x + 1) - 1 (\sin x + 1) = 0$

$(2 \sin x - 1)(\sin x + 1) = 0$

$\sin x = 1/2$ or $\sin x = -1$ (not possible)

$x = \pi/6, 5\pi/6$

Hence number of roots = 2

2.[D] $2 \sin^2 x + 3 \sin x - 2 > 0$

$2 \sin^2 x + 4 \sin x - \sin x - 2 > 0$

$2 \sin x (\sin x + 2) - 1 (\sin x + 2) > 0$

$(2 \sin x - 1)(\sin x + 2) > 0$

$\sin x > \frac{1}{2}$

$x \in \left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$ .....(i)

$x^2 - 2x + x - 2 < 0$

$x (x - 2) + 1 (x - 2) < 0$

$(x + 1)(x - 2) < 0$

$-1 < x < 2$ .....(ii)

From (i) and (ii) we get

$\pi/6 < x < 2$

$x \in (\pi/6, 2)$

3.[D] $a_1 + a_2 \cos 2x + \frac{1}{2} a_3 (1 - \cos 2x) = 0$

$2a_1 + 2a_2 \operatorname{csos} 2x + a_3 - a_3 \cos 2x = 0$

$\cos 2x = \left(\frac{2a_1 + a_3}{a_3 - 2a_2}\right)$

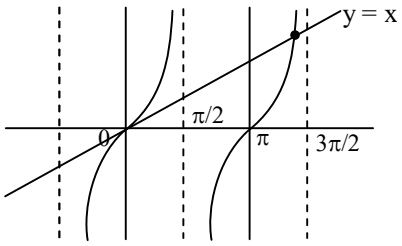
$\cos 2x = \frac{2a_1 + a_3}{a_3 - 2a_2}$

since $-1 \le \cos 2x \le 1$

then $-1 \le \frac{2a_1 + a_3}{a_3 - 2a_2} \le 1$

Hence, Infinite triplet possible.

4.[C] By the graphs of y = x and y = tan x



We see the smallest positive roots of tan x = x lies in $(\pi, 3\pi/2)$

5.[B] $\tan^2\theta + \dfrac{1+\tan^2\theta}{1-\tan^2\theta} = 1$

$\dfrac{\tan^2\theta(1-\tan^2\theta)+1+\tan^2\theta}{1-\tan^2\theta} = 1$

$2\tan^2\theta - \tan^4\theta + 1 = 1 - \tan^2\theta$

$\tan^4\theta - 3\tan^2\theta = 0$

$\tan^2\theta\,(\tan^2\theta - 3) = 0$

$\tan^2\theta = 0$

$\theta = n\pi$

$\tan^2\theta = \tan^2 \pi/3$

$\theta = n\pi \pm \pi/3$

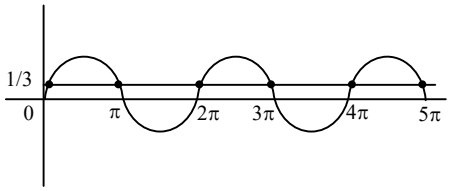
6.[B] $\cos x + \cos y = 3/2$

$2\cos\dfrac{x+y}{2}\cos\dfrac{x-y}{2} = 3./2$

$2\cos\dfrac{\pi}{3}\cos\dfrac{x-y}{2} = 3/2$

$\cos\dfrac{x-y}{2} = 3/2$ which is not possible.

7.[C] By graph



$3\sin^2x - 6\sin x - \sin x + 2 = 0$

$3\sin x(\sin x - 2) - 1(\sin x - 2) = 0$

$(\sin x - 2)(3\sin x - 1) = 0$

If $\sin x - 2 = 0$

$\sin x \neq 2$

$\sin x = 1/3$

Hence no of value lies $[0, 5\pi] = 6$

8. [B] $\dfrac{7}{\sqrt{74}}\cos x + \dfrac{5}{\sqrt{74}}\sin x = \dfrac{2k+1}{\sqrt{74}}$

$\cos(x - \alpha) = \dfrac{2k+1}{\sqrt{74}}$ where $\alpha = \tan^{-1}\dfrac{5}{7}$

$-1 \le \dfrac{2k+1}{\sqrt{74}} \le 1$

$-\sqrt{74} \le 2k + 1 \le \sqrt{74}$

$\dfrac{-\sqrt{74}-1}{2} \le k \le \dfrac{\sqrt{74}-1}{2}$

$k = -4, -3, -2, -1, 0, 3, 2, 1$

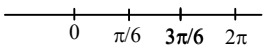
No. of integral value of k = 8

9.[D] $2\sin^2\theta - 5\sin\theta + 2 > 0$

$2\sin^2\theta - 4\sin\theta - \sin\theta + 2 > 0$

$2\sin\theta(\sin\theta - 2) - 1(\sin\theta - 2) > 0$

$(2\sin\theta - 1)(\sin\theta - 2) > 0$



$\theta \in (0, \pi/6) \cup (5\pi/6, 2\pi)$

10. [C] $2\sin^2\theta - (1 - 2\sin^2\theta) = 0$

$4\sin^2\theta - 1 = 0$

$\sin^2\theta = \dfrac{1}{4}$

$\sin\theta = \pm\dfrac{1}{2}$

$\theta = \pi/6, 5\pi/6, 7\pi/6, 11\pi/6$

$2\cos^2\theta - 3\sin\theta = 0$

$2(1 - \sin^2\theta) - 3\sin\theta = 0$

$2\sin^2\theta + 3\sin\theta - 2 = 0$

$2\sin^2\theta + 4\sin\theta - \sin\theta - 2 = 0$

$2\sin\theta(\sin\theta + 2) - 1(\sin\theta + 2) = 0$

$(2\sin\theta - 1)(\sin\theta + 2) = 0$

$\sin\theta \neq -2$

$\sin\theta = \dfrac{1}{2} = \sin\pi/6$

$\theta = \pi/6, 5\pi/6$

Hence No of pair of sol = 2

11.[3] $\tan\theta = \cot 5\theta$

$\Rightarrow \cos 6\theta = 0$

$\Rightarrow 4\cos^3 2\theta - 3\cos 2\theta = 0$

$\Rightarrow \cos 2\theta = 0 \text{ or } \pm \frac{\sqrt{3}}{2}$

$\sin 2\theta = \cos 4\theta$

$\Rightarrow 2\sin^2 2\theta + 2\sin 2\theta - \sin 2\theta - 1 = 0$

$\sin 2\theta = -1 \text{ or } \sin 2\theta = \frac{1}{2}$

$\cos 2\theta = 0 \text{ and } \sin 2\theta = -1$

$\Rightarrow 2\theta = -\pi/2 \Rightarrow \theta = -\pi/4$

$\cos\theta = 0 \text{ \& } \sin 2\theta = \frac{1}{2}$

$2\theta = \pi/6, 5\pi/6 \Rightarrow \theta = \frac{\pi}{12}, \frac{5\pi}{12}$

$\theta = \frac{-\pi}{4}, \frac{\pi}{12}, \frac{5\pi}{12}$

12.[7] Let $\frac{\pi}{n} = x$

$\frac{1}{\sin x} = \frac{1}{\sin 2x} + \frac{1}{\sin 3x}$

$\sin 2x \sin 3x = \sin x \sin 3x + \sin x \sin 2x$

$\Rightarrow \cos x - \cos 5x = \cos 2x - \cos 4x + \cos x - \cos 3x$

$\cos 2x - \cos 4x + \cos 5x - \cos 3x = 0$

$\Rightarrow 2\sin 3x \sin x + s \sin 4x \sin(-x) = 0$

$2\sin x(\sin 3x - \sin 4x) = 0$

$-2.2\sin x \cos \frac{7x}{2} \cos n \frac{x}{2} = 0$

$x = k\pi. \frac{7x}{2} = (2k+1)\frac{\pi}{2}$

$\frac{x}{2} = (2x+1)\frac{\pi}{2}; x \in I$

$x = \frac{\pi}{n}$ only possible value of n is '7'.