[SINGLE CORRECT CHOICE TYPE]

1. If $(\sin^2 x - \sin x) + \left(\sec^2 x + \frac{4}{\sqrt{3}}\sec x\right) + \frac{19}{12} = 0$, then complete set of solution is (where n ∈ I)

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

2. If $\operatorname{cosec}\theta = \frac{-5}{4}$, where $\frac{3\pi}{2} < \theta < 2\pi$, then value of $\frac{\sin^3\theta + 2\cos^3\theta}{\tan\theta}$ is -

(A) $\frac{3}{50}$ (B) $-\frac{1}{50}$ (C) $\frac{1}{50}$ (D) $-\frac{3}{50}$

3. Sum of all the solutions of the equation $1 + \cos x + \cos^2 x + \cos^3 x = 0$ in $\left[-\frac{7\pi}{4}, \frac{15\pi}{4}\right]$ is equal to

(A) 2π (B) 3π (C) 4π (D) π

4. Number of solution(s) of the equation $2\sin^3\theta + 3\cos^2\theta - 3\sin\theta = 1$ in the interval $(-\pi, \pi)$ is

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

5. Number of degrees in the smallest positive angle x such that $8\sin x \cos^5 x - 8\sin^5 x \cos x = 1$, is

(A) 5° (B) 7.5° (C) 10° (D) 15°

6. Range of $f(x) = 4\sin^2 x - 4\sin x + 2$ is

(A) [2,10] (B) [1,10] (C) [1,2] (D) [0,10]

[MULTIPLE CORRECT CHOICE TYPE]

7. Let $0 < \theta_1 < \theta_2 < \theta_3 < \ldots$ denotes the solutions of the equation $2\cos^2\theta = \sin\theta + 1$. Mark the correct options

(A) $\theta_3 = \frac{3\pi}{2}$

(B) $\theta_2 + \theta_7 = 5\pi$

(C) θ_2 is arithmetic mean of θ_1 and θ_3

(D) Total number of principal solutions are 13

8. If sum of all the solution(s) of the equation $\cos^2\left(x + \frac{\pi}{6}\right) + \cos^2\frac{\pi}{6} = \sin^2\frac{\pi}{3} + 2\cos\left(x + \frac{\pi}{6}\right)\cos\frac{\pi}{3}$, where $x \in (-\pi, \pi)$, is $k\pi$ and number of solution(s) of the given equation is n, then -

(A) $2n - k = \frac{13}{2}$ (B) $2nk = -3$

(C) $2k + n = 2$ (D) $\frac{nk}{2} = -3$

[SUBJECTIVE TYPE]

Find general solution for θ from Q.9 to Q.10

9. (i) $2\sin^2\theta + \sqrt{3}\cos\theta + 1 = 0$

(ii) $4\cos^2\theta + \sqrt{3} = 2[\sqrt{3}+1]\cos\theta$

(iii) $4\cos\theta - 3\sec\theta = 2\tan\theta$

(iv) $4\cos^2\theta\sin\theta - 2\sin^2\theta = 3\sin\theta$

(v) $\cos(10\theta+4)+4\sqrt{2}\sin(5\theta+2)=4$

(vi) $4\sin^4\theta + \cos^4\theta = 1$

(vii) $\sin^2\theta = 1/4$

(viii) $5\cos^2\theta + 7\sin^2\theta = 6$

(ix) $\cot\theta - \tan\theta = 2$

(x) $\tan\theta + \cot\theta = 2$

10. (i) $\tan\theta + \tan 2\theta + \sqrt{3}\tan 2\theta\tan\theta = \sqrt{3}$.

(ii) $\tan\theta + \tan 4\theta + \tan 7\theta = \tan\theta\tan 4\theta\tan 7\theta$.

(iii) $\cot\theta + \tan\theta = 2\operatorname{cosec}\theta$.

(iv) $\cot\theta - \tan\theta = \sec\theta$

(v) $\sin 9\theta = \sin\theta$

(vi) $\tan p\theta = \cot q\theta$

11. What is most general value of θ which satisfies both the equations ?

(a) $\sin\theta = -1/2$ and $\tan\theta = 1/\sqrt{3}$

(b) $\cos\theta = -1/\sqrt{2}$ and $\tan\theta = 1$

(c) $\cos\theta = 1/\sqrt{2}$ and $\tan\theta = -1$

(d) $\tan\theta = \sqrt{3}$ and $\operatorname{cosec}\theta = -2/\sqrt{3}$

12. (a) Solve : $\sin^2\theta - \cos\theta = \frac{1}{4}$ in the interval $0 \le \theta \le 2\pi$.

(b) Solve : $2\sin^2\theta = 3\cos\theta$ in the interval $0 \le \theta \le 2\pi$.

(c) $\sin 5\theta = \cos 2\theta$, in the interval $0 \le \theta \le 180°$

(d) $\sin 2\theta = \cos 3\theta$, in the interval $0 \le \theta \le 360°$

[SINGLE CORRECT CHOICE TYPE]

1. Number of solution of the equation $\sin\frac{5x}{2}-\sin\frac{x}{2}=2$ in the interval $[0,2\pi]$ is -

(A) 0 (B) 1 (C) 2 (D) more than 2

2. Let the equation $3\sin x + 4\cos\lambda x = 7$ has atleast one solution, then the least positive integral value of λ is eual to

(A) 7 (B) 5 (C) 4 (D) None of these

3. The equation $\sin^4x - 2\cos^2x + a^2 = 0$ can be solved if

(A) $-\sqrt{3}\le a\le\sqrt{3}$ (B) $-\sqrt{2}\le a\le\sqrt{2}$ (C) $-1\le a\le 1$ (D) none of these.

Paragraph for Question 4 to 5

Let $a = \sin x + \sin 2x + \sin 3x$, $b = \cos x + \cos 2x + \cos 3x$

and $f(x) = (\cos^2x + \cos^2 2x + \cos^2 3x) - (\sin^2x + \sin^2 2x + \sin^2 3x)$

On the basis of above information, answer the following questions.

4. The number of values of 'x' in $[0, 3\pi]$ for which $a = b$ is

(A) 3 (B) 5 (C) 9 (D) 10

5. If a, b are the roots of quadratic equation $y^2 - Ay + B = 0$, then general solution of x in the equation $A^2 - 2B = 0$ is

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

[MATRIX TYPE]

6.

	Column-I		Column-II
(A)	Number of integral values of 'k' for which the equation $7\sin x - 2\cos x = k^2$ has a solution is	(P)	5
(B)	The number of solutions of the equation $\text{cosec}x - \text{cosec}3x = 2\cos 2x$ in $(0, 2\pi)$ is	(Q)	6
(C)	Sum of the real roots of the equation $\lvert x-3\rvert^2 - \lvert x-3\rvert - 6 = 0$ is	(R)	7

[SUBJECTIVE TYPE]

Find general solution for the equation given in Q.7 to Q.10

7. $5\cos 2\theta + 2\cos^2\left(\frac{\theta}{2}\right) + 1 = 0$

8. (i) $\cos^2\theta - 2\cos\theta = 4\sin\theta - \sin 2\theta$

(ii) $3(\cos\theta - \sin\theta) = 1 + \cos 2\theta - \sin 2\theta$.

9. (i) $\sqrt{3}\sin\theta - \cos\theta = \sqrt{2}$

(ii) $6\sin^2\theta + 2\sin^2 2\theta = 5$.

(iii) $\sin^2\theta\,(1 + \tan\theta) = 3\sin\theta\,(\cos\theta - \sin\theta) + 3$

(iv) $1 + \sin 2\theta = (\sin 3\theta - \cos 3\theta)^2$.

(v) $\cos 4\theta = \cos^2 3\theta$.

(vi) $\sin^3\theta\cos\theta - \cos^3\theta\sin\theta = 1/4$.

(vii) $\cos 3\theta\cos^3\theta + \sin 3\theta\sin^3\theta = 0$

(viii) $\cos\theta + \cos 2\theta + \cos 3\theta = 0$

(ix) $\cos 6\theta + \cos 4\theta + \cos 2\theta + 1 = 0$

(x) $\sin\theta + \sin 3\theta + \sin 5\theta = 0$

10. (i) $\cos\theta\cos 2\theta\cos 3\theta = \frac{1}{4}$

(ii) $\cos\theta + \cos 7\theta + \cos 3\theta + \cos 5\theta = 0$

(iii) $\sin\theta + \sqrt{3}\cos\theta = \sqrt{2}$

(iv) $\sqrt{3}\cos\theta + \sin\theta = 1$

11. If $\sin^2 x + \cos^2 y = 2\sec^2 z$ then find x, y & z.

12. Prove that $\operatorname{cosec} x + \operatorname{cosec} 2x + \operatorname{cosec} 4x + \ldots + \operatorname{cosec} 2^n x = \cot\frac{x}{2} - \cot 2^n x$

13. Prove that $\frac{\sin x}{\cos 3x} + \frac{\sin 3x}{\cos 9x} + \frac{\sin 9x}{\cos 27x} = \frac{1}{2}(\tan 27x - \tan x)$

14. Find number of solutions of the equation $\log_{\cos x}\sin x + \log_{\sin x}\cos x = 2$ in $[-5\pi, 4\pi]$.

15. Find number of common solutions of the equation $2\cos^2 x - 3\cos x + 1 = 0$ and $\tan\left(\frac{3x}{4}\right) + 1 = 0$, where –

$\pi < x \le 3\pi$.

Answer Key

1. (A) **2.** (C) **3.** (B) **4.** (C) **5.** (B) **6.** A–P; B–R; C–Q

7. (i) $2n\pi \pm \frac{\pi}{3}$, $2m\pi \pm \cos^{-1}\left(-\frac{3}{5}\right)$

8. (i) $\theta = n\pi + \alpha$, where $\tan\alpha = -\frac{1}{2}$ (ii) $\theta = n\pi + \frac{\pi}{4}$

9. (i) $\theta = n\pi + (-1)^n\frac{\pi}{4} + \frac{\pi}{6}$ (ii) $\theta = n\pi \pm \frac{\pi}{4}$ (iii) $n\pi + \frac{3\pi}{4}, m\pi \pm \frac{\pi}{3}$

(iv) $\theta = \frac{n\pi}{4}, \theta = (2m+1)\frac{\pi}{4}$ (v) $n\pi, \frac{m\pi}{2} \pm \frac{\pi}{12}$ (vi) $(4n+3)\frac{\pi}{8}$

(vii) $(2n+1)\frac{\pi}{4}$ (viii) $(2n+1)\frac{\pi}{4}, \left(2m\pi + \frac{2\pi}{3}\right)$ (ix) $(2n+1)\frac{\pi}{4}, (2m+1)\frac{\pi}{6}, (2p+1)\frac{\pi}{2}$

(x) $\theta = \frac{n\pi}{3}, m\pi \pm \frac{\pi}{3}$

[SINGLE CORRECT CHOICE TYPE]

1. If $2\sin^2\left(x+\frac{\pi}{4}\right)+\sqrt{3}\cos 2x = a^2-4a+7$ for $x \in [-2\pi, 2\pi]$, then

(A) a = 2 (B) a = 3

(C) Number of values of x is 5 (D) sum of values of x is $-\frac{5\pi}{3}$

2. Number of solutions of the equation $\cos x = 1 + \sin^4 x$ in interval $[-20\pi, 40\pi]$, is

(A) 31 (B) 32 (C) 62 (D) 63

3. Number of solutions of the equation $\log_{\cos x}\left(\sqrt{1-\cos^2 x}\right)=1$ in the interval $x \in (-2\pi, 2\pi)$, is

(A) 4 (B) 8 (C) 6 (D) 0

4. Number of solutions of the equation $\cos^4 2x + 2\sin^2 2x = 17(\cos x + \sin x)^8$, $0 < x < 2\pi$ is

(A) 4 (B) 8 (C) 10 (D) 16

[MORE THAN ONE CORRECT ANSWER TYPE]

5. If $\sin(x + 20°) = 2\sin x\cos 40°$ where $x \in \left(0, \frac{\pi}{2}\right)$ then which of the following hold good ?

(A) $\tan 4x = \sqrt{3}$ (B) $\text{cosec}\, 4x = 2$ (C) $\sec\frac{x}{2} = \sqrt{6}-\sqrt{2}$ (D) $\cot\frac{x}{2} = (2+\sqrt{3})$

6. The value of x satisfying the equation $\cos(\ln x) = 0$, is

(A) $e^{\pi/2}$ (B) $e^{-(2009)\pi/2}$ (C) $e^{1000\pi}$ (D) $e^{-3\pi/2}$

7. If $2\sin y - \cos(x - y) - 2\sin x = 5$, then

(A) x = y (B) $x + y = 2k\pi,\ k \in I$

(C) $x - y = 2k\pi,\ k \in I$ (D) $y = 2m\pi + \frac{\pi}{2},\ x = 2n\pi - \frac{\pi}{2},\ n, m \in I$

[MATRIX TYPE]

Q.8 has **four** statements (A,B,C and D) given in **Column-I** and **five** statements (P, Q, R, S and T) given in **Column-II**. Any given statement in **Column-I** can have correct matching with one or more statement(s) given in**Column-II.**

8.

Column-I	Column-II
(A) Number of solutions of $\sin x = \frac{x}{10}$ is	(P) 4
(B) Number of ordered pairs (x,y) satisfying $\lvert x\rvert + \lvert y\rvert = 2$ and $\sin\left(\frac{\pi x^2}{3}\right)=1$ is	(Q) 7
(C) The number of ordered pairs (x, y) satisfying the equation $\sin x + \sin y = \sin(x + y)$ and $\lvert x\rvert + \lvert y\rvert = 1$ is	(R) 6

[LINKED COMPREHENSION TYPE]

Paragraph for Question 9 and 10

Let $f(x) = \cos x + \sin x - 1$ and $g(x) = \sin 2x - 2$.

On the basis of above information, answer the following questions :

9. If $f(x) = g(x)$, then number of solutions in the interval $x \in \left[-\pi, \frac{7\pi}{2}\right]$, is

(A) 4 (B) 9 (C) 10 (D) None of these

10. If $f(x) = k$, $x \in [0, \pi]$ has atleast one solution, then number of possible integral values of k is

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

[SUBJECTIVE TYPE]

11. Find general solution for the given equation :

(i) $\tan\left(\frac{\pi}{2}\sin\theta\right) = \cot\left(\frac{\pi}{2}\cos\theta\right)$

(ii) $\tan\theta + \tan\left(\theta + \frac{\pi}{3}\right) + \tan\left(\theta + \frac{2\pi}{3}\right) = 3$

(iii) $\sin^3 x + \sin x \cos x + \cos^3 x = 1$.

(iv) $1 + \sin^3 x + \cos^3 x = \frac{3}{2}\sin 2x$

(v) $2^{2+\sin^2 x} + 2^{2+\operatorname{cosec}^2 x} = -4x^2 + 4\pi x + \left(16 - \pi^2\right)$

(vi) $\sin^2 x \tan x + \cos^2 x \cot x - \sin 2x = 1 + \tan x + \cot x$

12. Solve the system of equations

(a) $x + y = \pi/4$, $\tan x + \tan y = 1$

(b) $x + y = 2\pi/3$, $\cos x + \cos y = 3/2$ where x and y are real.

13. solve the following equations for x and y

(i) $3^{\sin x + \cos y} = 1,\ 25^{\sin^2 x + \cos^2 y} = 5\ ;\ 0 < x < 2\pi,\ 0 < y < 2\pi$

(ii) $5^{(\operatorname{cosec}^2 x - 3\sec^2 y)} = 1,\ 2^{(2\operatorname{cosec} x + \sqrt{3}|\sec y|)} = 64\ ;\ 0 < x < 2\pi,\ 0 < y < 2\pi$

14. Find the general values of x and y satisfying the equations $5 \sin x \cos y = 1$, $4 \tan x = \tan y$.

15. If $\tan(\pi\cos\theta) = \cot(\pi\sin\theta)$, prove that $\cos\left(\theta - \frac{\pi}{4}\right) = \pm\frac{1}{2\sqrt{(2)}}$

16. The value of $\theta \in (0, 2\pi)$ for which $2\sin^2\theta - 5\sin\theta + 2 > 0$ are

Ans: $\left(0, \frac{\pi}{6}\right) \cup \left(\frac{5\pi}{6}, 2\pi\right)$

17. Solve the trigonometric inequality

(1) $\sin x \ge \frac{1}{2}$ (2) $\sin x > \cos x$

Ans (1) $2n\pi + \frac{\pi}{6} \le x \le 2n\pi + \frac{5\pi}{6}\ n \in z$ (2) $2n\pi + \frac{\pi}{4} < x < 2n\pi + \frac{5\pi}{4}\ n \in z$

18. Solve: cos 2x > |sin x| $x \in \left(-\frac{\pi}{2}, \pi\right)$

Ans: $x \in \left(-\frac{\pi}{6}, \frac{\pi}{6}\right) \cup \left(\frac{5\pi}{6}, \pi\right)$

19. Solve: $\sin\theta + \sqrt{3}\cos\theta \geq 1;\ -\pi < \theta < \pi$

Ans: $-\frac{\pi}{6} \leq \theta \leq \frac{\pi}{2}$

20. Solve : $2\cos^2\theta + \sin\theta \leq 2$ where $\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2}$

Ans: $\theta \in \left[\frac{\pi}{2}, \frac{5\pi}{6}\right] \cup \left[\pi, \frac{3\pi}{2}\right]$

Answer Key

1. (A) **2.** (A) **3.** (A) **4.** (A) **5.** (CD) **6.** (ABD) **7.** (BD)

8. A–Q; B–P; C–R **9.** (D) **10.** (C) **11.** (i) $\theta = 2n\pi, 2n\pi + \frac{\pi}{2}$ (ii) $\theta = \frac{n\pi}{3} + \frac{\pi}{12}$

(iii) $2n\pi + \frac{\pi}{2}$ or $2n\pi$ (iv) $x = 2n\pi + \pi, 2n\pi - \frac{\pi}{2}$ (v) $\frac{\pi}{2}$ (vi) $x = \frac{n\pi}{2} + (-1)^n\left(\frac{-\pi}{12}\right)$

12. (a) $x = \frac{\pi}{4}, y = 0;\ x = 0, y = \frac{\pi}{4}$ (b) ϕ

13. (i) $\left(\frac{\pi}{6}, \frac{2\pi}{3}\right), \left(\frac{\pi}{6}, \frac{4\pi}{3}\right), \left(\frac{5\pi}{6}, \frac{2\pi}{3}\right), \left(\frac{5\pi}{6}, \frac{4\pi}{3}\right), \left(\frac{7\pi}{6}, \frac{\pi}{3}\right), \left(\frac{7\pi}{6}, \frac{5\pi}{3}\right), \left(\frac{11\pi}{6}, \frac{\pi}{3}\right), \left(\frac{11\pi}{6}, \frac{5\pi}{3}\right)$

(ii) $\left(\frac{\pi}{6}, \frac{\pi}{6}\right), \left(\frac{\pi}{6}, \frac{11\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{11\pi}{6}\right), \left(\frac{\pi}{6}, \frac{5\pi}{6}\right), \left(\frac{\pi}{6}, \frac{7\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{5\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{7\pi}{6}\right)$

14. $x = \frac{1}{2}\left(n\pi + \frac{\pi}{2} - (-1)^n \sin^{-1}\left(\frac{3}{5}\right)\right)$ $y = \frac{1}{2}\left(3n\pi + \frac{\pi}{2} + (-1)^n \sin^{-1}\left(\frac{3}{5}\right)\right)$

ANSWER KEY

RACE-16

1. (C) **2.** (A) **3** (B) **4.** (B) **5.** (B) **6.** (B) **7.** (A) (B) (C) **8.**(A) (B) (C)

9. (i) $2n\pi \pm \frac{5\pi}{6}$ (ii) $\theta = 2n\pi \pm \frac{\pi}{3}$ or $\theta = 2n\pi \pm \frac{\pi}{6}$ (iii) $\theta = n\pi - (-1)^n \frac{3\pi}{10}$ or $\theta = n\pi + (-1)^n \frac{\pi}{10}$

(iv) $\theta = n\pi$ or $\theta = n\pi - (-1)^n \frac{3\pi}{10}$ or $\theta = n\pi + (-1)^n \frac{\pi}{10}$ (v) $\frac{1}{5}\left[n\pi + (-1)^n \frac{\pi}{4}\right] - \frac{2}{5}$

(vi) $\theta = n\pi$ or $n\pi + (-1)^n \alpha$ where find $\sin\alpha = \sqrt{2/5}$ (vii) $\theta = n\pi \pm \frac{\pi}{6}$

(viii) $\theta = n\pi \pm \frac{\pi}{4}$ (ix) $\theta = \frac{n\pi}{2} + \pi/8$ (x) $\theta = \frac{n\pi}{2} + (-1)^n \frac{\pi}{4}$

10. (i) $\theta = \frac{n\pi}{3} + \frac{\pi}{9}$ (ii) $\theta = \frac{n\pi}{12}$ (iii) $\theta = 2n\pi \pm \frac{\pi}{3}$ (iv) $\theta = n\pi + (-1)^n . \frac{\pi}{6}$

(v) $\theta = (2n+1)\pi/10$ or $\theta = \frac{n\pi}{4}$ (viii) $\theta = \frac{(2n+1)}{(p+q)} . \frac{\pi}{2}$

11. (i) $\theta = 2n\pi + \frac{7\pi}{6}$ (ii) $\theta = (2n+1)\pi + \pi/4$ (iii) $2n\pi - \frac{\pi}{4}$ (iv) $2n\pi + \frac{4\pi}{3}$

12. (a) $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$ (b) $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$ (c) $\theta = \frac{\pi}{14}, \frac{5\pi}{14}, \frac{9\pi}{14}, \frac{13\pi}{14}, \frac{\pi}{6}, \frac{5\pi}{6}$ (d) $\theta = \frac{\pi}{10}, \frac{5\pi}{10}, \frac{9\pi}{10}, \frac{13\pi}{10}, \frac{17\pi}{10}, \frac{3\pi}{2}$

RACE-17

1. (A) **2.** (C) **3.** (B) **4.** (C) **5.** (B) **6.** A–P; B–R; C–Q

7. (i) $2n\pi \pm \frac{\pi}{3}$, $2m\pi \pm \cos^{-1}\left(-\frac{3}{5}\right)$ **8.** (i) $\theta = n\pi + \alpha$, where $\tan\alpha = -\frac{1}{2}$ (ii) $\theta = n\pi + \frac{\pi}{4}$

9. (i) $\theta = n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{6}$ (ii) $\theta = n\pi \pm \frac{\pi}{4}$ (iii) $n\pi + \frac{3\pi}{4}, m\pi \pm \frac{\pi}{3}$

(iv) $\theta = \frac{n\pi}{4}, \theta = (2m+1)\frac{\pi}{4}$ (v) $n\pi, \frac{m\pi}{2} \pm \frac{\pi}{12}$ (vi) $(4n+3)\frac{\pi}{8}$

(vii) $(2n+1)\frac{\pi}{4}$ (viii) $(2n+1)\frac{\pi}{4}, \left(2m\pi + \frac{2\pi}{3}\right)$ (ix) $(2n+1)\frac{\pi}{4}, (2m+1)\frac{\pi}{6}, (2p+1)\frac{\pi}{2}$

(x) $\theta = \frac{n\pi}{3}, m\pi \pm \frac{\pi}{3}$

10. (i) $(2n+1)\frac{\pi}{8}, m\pi \pm \frac{\pi}{3}$ (ii) $(2n+1)\frac{\pi}{8}, (2m+1)\frac{\pi}{4}$, $(2p+1)\frac{\pi}{2}$ (iii) $\theta = n\pi + (-1)^n . \frac{\pi}{4} - \frac{\pi}{3}$ (iv) $2n\pi \pm \frac{\pi}{3} + \frac{\pi}{6}$

11. $x = (2n+1)\frac{\pi}{2}, y = p\pi, z = m\pi$ **14.** 4 **15.** 2

RACE-18

1. (A) **2.** (A) **3.** (A) **4.** (A) **5.** (CD) **6.** (ABD) **7.** (BD)

8. A–Q; B–P; C–R **9.** (D) **10.** (C) **11.** (i) $\theta = 2n\pi, 2n\pi + \frac{\pi}{2}$ (ii) $\theta = \frac{n\pi}{3} + \frac{\pi}{12}$

(iii) $2n\pi + \frac{\pi}{2}$ or $2n\pi$ (iv) $x = 2n\pi + \pi, 2n\pi - \frac{\pi}{2}$ (v) $\frac{\pi}{2}$ (vi) $x = \frac{n\pi}{2} + (-1)^n\left(\frac{-\pi}{12}\right)$

12. (a) $x = \frac{\pi}{4}, y = 0;\ x = 0, y = \frac{\pi}{4}$ (b) ϕ

13. (i) $\left(\frac{\pi}{6}, \frac{2\pi}{3}\right), \left(\frac{\pi}{6}, \frac{4\pi}{3}\right), \left(\frac{5\pi}{6}, \frac{2\pi}{3}\right), \left(\frac{5\pi}{6}, \frac{4\pi}{3}\right), \left(\frac{7\pi}{6}, \frac{\pi}{3}\right), \left(\frac{7\pi}{6}, \frac{5\pi}{3}\right), \left(\frac{11\pi}{6}, \frac{\pi}{3}\right), \left(\frac{11\pi}{6}, \frac{5\pi}{3}\right)$

(ii) $\left(\frac{\pi}{6}, \frac{\pi}{6}\right), \left(\frac{\pi}{6}, \frac{11\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{11\pi}{6}\right), \left(\frac{\pi}{6}, \frac{5\pi}{6}\right), \left(\frac{\pi}{6}, \frac{7\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{5\pi}{6}\right), \left(\frac{5\pi}{6}, \frac{7\pi}{6}\right)$

14. $x = \frac{1}{2}\left(n\pi + \frac{\pi}{2} - (-1)^n \sin^{-1}\left(\frac{3}{5}\right)\right)$ $y = \frac{1}{2}\left(3n\pi + \frac{\pi}{2} + (-1)^n \sin^{-1}\left(\frac{3}{5}\right)\right)$