MATHS

BOOKS - VIKAS GUPTA MATHS (HINGLISH)

TRIGONOMETRIC EQUATIONS

Exercise 1 Single Choice Problems

1. Let x and y be 2 real numbers which satisfy the equations $\left(\tan^2 x - \sec^2 y\right) = \dfrac{5a}{6} - 3$ and $\left(-\sec^2 x + \tan^2 y\right) = a^2$, then the product of all possible value's of a can be equal to :

A. 0

B. $-\dfrac{2}{3}$

C. -1

D. $-\dfrac{3}{2}$

Answer: C

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2. The general solution of the equation
$\tan^2(x + y) + \cot^2(x + y) = 1 - 2x - x^2$ lie on the line is :

A. $x = -1$

B. $x = -2$

C. $y = -1$

D. $y = -2$

Answer: A

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3. General solution of the equation :

$\sin x + \cos x = \min_{a \varepsilon R} \{1, a^2 - 4a + 6\}$ is :

A. $\dfrac{n\pi}{2} + (-1)^n \dfrac{\pi}{4}$

B. $2n\pi + (-1)^n \dfrac{\pi}{4}$

C. $n\pi + (-1)^{n+1} \dfrac{\pi}{4}$

D. $n\pi + (-1)^n \dfrac{\pi}{4} - \dfrac{\pi}{4}$

Answer: D

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4. The number of solutions of the equation

$$\left(2\sin\left(\dfrac{\sin x}{2}\right)\right)\left(\cos\left(\dfrac{\sin x}{2}\right)\right)\left(\sin\left(2\tan\dfrac{x}{2}\ \cos^2\dfrac{x}{2}\right) - 3\right) + 2 = 0 \text{ in}$$

$[0, 2\pi]$ is :

A. 0

B. 1

C. 2

D. 4

Answer: A

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5. Number of solution of $\tan(2x) = \tan(6x)$ in $(0, 3\pi)$ is :

A. 4

B. 5

C. 3

D. None of these

Answer: B

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6. 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

A. 0

B. 2

C. 6

D. 8

Answer: C

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7. The number of different values of θ satisfying the equation $\cos\theta + \cos 2\theta = -1$, and at the same time satisfying the condition $0 < \theta < 360°$ is :

A. 1

B. 2

C. 3

D. 4

Answer: D

8. The total number of solution of the equation $\max\,(\sin x,\, \cos x) = \dfrac{1}{2}$

for $x \in (-2\pi,\, 5\pi)$ is equal to (A) 3 (B) 6 (C) 7 (D) 8

A. 3

B. 6

C. 7

D. 8

Answer: C

9. The general value of x satisfying the equation

$2\cot^2 x + 2\sqrt{3}\cot x + 4\mathrm{cosec}x + 8 = 0$ is : (where $n \in I$)

A. $n\pi - \dfrac{\pi}{6}$

B. $n\pi + \dfrac{\pi}{6}$

C. $2n\pi - \dfrac{\pi}{6}$

D. $2n\pi + \dfrac{\pi}{6}$

Answer: C

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10. The general solution of the equation $\sin^2 x + \cos^2 3x = 1$ is equal to :

(where $n \in I$)

A. $x = \dfrac{n\pi}{2}$

B. $x = n\pi + \dfrac{\pi}{4}$

C. $x = \dfrac{n\pi}{4}$

D. $x = n\pi + \dfrac{\pi}{2}$

Answer: C

11. The values of x between 0 and 2π which satisfy the equation $\sin x \sqrt{8 \cos^2 x} = 1$ are in A.P. with common difference is

A. $\dfrac{\pi}{4}$

B. $\dfrac{\pi}{3}$

C. $\dfrac{\pi}{2}$

D. $\dfrac{2\pi}{3}$

Answer: A

12. Number of solutions of $\displaystyle\sum_{r=1}^{5} \cos rx = 5$ in the interval $[0, 4\pi]$ is

A. 0

B. 2

C. 3

D. 7

Answer: C

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13. The solution of

$$4\sin^2 x + \tan^2 x + \cos ec^2 x + \cot^2 x - 6 = 0 \, is \, (n \in Z) \quad n\pi \pm \frac{\pi}{4} \quad \text{(b)}$$

$$2n\pi \pm \frac{\pi}{4} \quad n\pi + \frac{\pi}{3} \quad \text{(d)} \, n\pi - \frac{\pi}{6}$$

A. $n\pi \pm \dfrac{\pi}{4}$

B. $2n\pi \pm \dfrac{\pi}{4}$

C. $n\pi + \dfrac{\pi}{3}$

D. $n\pi - \dfrac{\pi}{6}$

Answer: A

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14. Smallest positive x satisfying the equation $\cos^3 3x + \cos^3 5x = 8\cos^3 4x \cdot \cos^3 x$ is :

A. $15°$

B. $18°$

C. $22.5°$

D. $30°$

Answer: B

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15. The general solution of the equation $\sin^{100} x - \cos^{100} x = 1$ is (where n ∈ I)

A. $2n\pi + \dfrac{\pi}{2}$

B. $n\pi + \dfrac{\pi}{2}$

C. $2n\pi - \dfrac{\pi}{2}$

D. $n\pi$

Answer:

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16. Number of solution (s) of equation $\sin\theta = \sec^2 4\theta$ in $[0, \pi]$ is/are :

A. 0

B. 1

C. 2

D. 3

Answer: B

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17. The number of solutions of the equation $4\sin^2 x + \tan^2 x + \cot^2 x + \operatorname{cosec}^2 x = 6$ in $[0, 2\pi]$

A. 1

B. 2

C. 3

D. 4

Answer: D

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18. One value of θ which satisfies the equation $\sin^4 \theta - 2\sin^2 \theta - 1$ lies between 0 and 2π.

A. 0

B. 2

C. 4

D. 8

Answer: A

19. Find the smallest positive number p for which the equation $\cos(p\sin x) = \sin(p\cos x)$ has a solution $x \in [0, 2\pi]$.

A. $\dfrac{\pi}{\sqrt{2}}$

B. $\dfrac{\pi}{2}$

C. $\dfrac{\pi}{2\sqrt{2}}$

D. $\dfrac{3\pi}{2\sqrt{2}}$

Answer: C

20. The total number of ordered pairs (x, y) satisfying $|x| + |y| = 2$, $\sin\left(\dfrac{\pi x^2}{3}\right) = 1$, is equal to 2 (b) 3 (c) 4 (d) 6

A. 2

B. 4

C. 6

D. 8

Answer: B

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21. The complete set of values of x, $x \in \left(-\dfrac{\pi}{2}, \pi\right)$ satisfying the inequality $\cos 2x > |\sin x|$ is :

A. $\left(-\dfrac{\pi}{6}, \dfrac{\pi}{6}\right)$

B. $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{6}\right) \cup \left(\dfrac{\pi}{6}, \dfrac{5\pi}{6}\right)$

C. $\left(-\dfrac{\pi}{2}, -\dfrac{\pi}{6}\right) \cup \left(\dfrac{5\pi}{6}, \pi\right)$

D. $\left(-\dfrac{\pi}{6}, \dfrac{\pi}{6}\right) \cup \left(\dfrac{5\pi}{6}, \pi\right)$

Answer: D

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22. The total number of solution of the equation

$\sin^4 x + \cos^4 x = \sin x \cos x$ in $[0, 2\pi]$ is :

A. 2

B. 4

C. 6

D. 8

Answer: A

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23. The number of solutions of ewuation $\sin. \dfrac{5x}{2} - \sin. \dfrac{x}{2} = 2$ in $[0, 2\pi]$

is

A. 1

B. 2

C. 0

D. Infinite

Answer: C

24. In the interval $\left[-\dfrac{\pi}{2}, \dfrac{\pi}{2} \right]$ the equation $\log_{\sin \theta}(\cos 2\theta) = 2$ has

A. No solution

B. One solution

C. Two solution

D. Infinite solution

Answer: B

25. If α and β are 2 distinct roots of equation $a\cos\theta + b\sin\theta = C$ then $\cos(\alpha + \beta) =$

A. $\dfrac{2ab}{a^2 + b^2}$

B. $\dfrac{2ab}{a^2 - b^2}$

C. $\dfrac{a^2 + b^2}{a^2 - b^2}$

D. $\dfrac{a^2 - b^2}{a^2 + b^2}$

Answer: D

Exercise 2 One Or More Than One Answer Is Are Correct

1. If $2\cos\theta + 2\sqrt{2} = 3\sec\theta$ where $\theta \in (0, 2\pi)$ then which of the following can be correct ?

A. $\cos\theta = \dfrac{1}{\sqrt{2}}$

B. $\tan\theta = 1$

C. $\sin\theta = -\dfrac{1}{\sqrt{2}}$

D. $\cot\theta = -1$

Answer: A::B::C::D

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2. In a triangle ABC if $\tan C < 0$ then :

A. $\tan A \tan B < 1$

B. $\tan A \tan B > 1$

C. $\tan A + \tan B + \tan C < 0$

D. $\tan A + \tan B + \tan C > 0$

Answer: A::C

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3. The inequality $4\sin 3x + 5 \geq 4\cos 2x + 5\sin x$ true for $x \in$

A. $\left[-\pi, \dfrac{3\pi}{2}\right]$

B. $\left[-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right]$

C. $\left[\dfrac{5\pi}{8}, \dfrac{13\pi}{8}\right]$

D. $\left[\dfrac{23\pi}{14}, \dfrac{41\pi}{14}\right]$

Answer: A::B::C::D

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4. The least difference between the roots, in the first quadrant $\left(0 \leq x \leq \dfrac{\pi}{2}\right)$, of the equation

$4\cos x\left(2 - 3\sin^2 x\right) + \left(\cos 2x + 1\right) = 0$, is

A. equal to $\dfrac{\pi}{2}$

B. $> \dfrac{\pi}{10}$

C. $< \dfrac{\pi}{2}$

D. $< \dfrac{\pi}{3}$

Answer: B::C::D

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5. General solution of the equation,

$\cos x \cdot \cos 6x = -1$ is x =

A. has 50 solutions in $[0, 100\pi]$

B. has 3 solutions in $[0, 3\pi]$

C. has even number of solutions in $(3\pi, 13\pi)$

D. has one solution in $\left[\dfrac{\pi}{2}, \pi\right]$

Answer: A::C::D

6. Identify the correct options :

A. $\dfrac{\sin 3\alpha}{\cos 2\alpha} > 0$ for $\alpha \in \left(\dfrac{3\pi}{8}, \dfrac{23\pi}{48} \right)$

B. $\dfrac{\sin 3\alpha}{\cos 2\alpha} < 0$ for $\alpha \in \left(\dfrac{13\pi}{48}, \dfrac{14\pi}{48} \right)$

C. $\dfrac{\sin 2\alpha}{\cos \alpha} < 0$ for $\alpha \in \left(-\dfrac{\pi}{2}, 0 \right)$

D. $\dfrac{\sin 2\alpha}{\cos \alpha} > 0$ for $\alpha \in \left(\dfrac{13\pi}{48}, \dfrac{14\pi}{48} \right)$

Answer: A::B::C::D

7. The equation $\sin^4 x + \cos^4 x + \sin 2x + k = 0$ must have real solutions if :

A. $k = 0$

B. $|k| \le \dfrac{1}{2}$

C. $-\dfrac{3}{2} \le k \le \dfrac{1}{2}$

D. $-\dfrac{1}{2} \le k \le \dfrac{3}{2}$

Answer: A::B::C

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8. Let

$$f(\theta) = \left(\cos \theta - \cos \dfrac{\pi}{8}\right)\left(\cos \theta - \cos \dfrac{3\pi}{8}\right)\left(\cos \theta - \cos \dfrac{5\pi}{8}\right)\left(\cos \theta - \cos \dfrac{7\pi}{8}\right)$$

then :

    A. maximum value of $f(\theta)\ \forall \theta \in R$ is $\dfrac{1}{4}$

    B. maximum value of $f(\theta)\ \forall \theta \in R$ is $\dfrac{1}{8}$

    C. $f(0) = \dfrac{1}{8}$

    D. Number of principle solutions of $f(\theta) = 0$ is 8

Answer: B::C::D

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9. If $\dfrac{\sin^2 2x + 4\sin^4 x - 4\sin^2 x \cdot \cos^2 x}{4 - \sin^2 2x - 4\sin^2 x} = \dfrac{1}{9}$ **and** $0 < x < \pi$. **Then the**

value of x is :

A. $\dfrac{\pi}{3}$

B. $\dfrac{\pi}{6}$

C. $\dfrac{2\pi}{3}$

D. $\dfrac{5\pi}{6}$

Answer: B::D

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10. Solve $\sin^2 \theta \tan \theta + \cos^2 \theta \cot \theta - \sin 2\theta = 1 + \tan \theta + \cot \theta$

A. $\dfrac{\pi}{4}$

B. π

C. $\dfrac{7\pi}{12}$

D. None of these

Answer: C

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11. If $\sin\theta + \sqrt{3}\cos\theta = 6y - y^2 - 11, \theta \in [0, 4\pi], y \in R$ holds for

A. no values of x and θ

B. one value of x and two values of θ

C. two values of x and two values of θ

D. two pairs of values of (x, θ)

Answer: B::D

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Exercise 3 Comprehension Type Problems

1. Consider f, g and h be three real valued function defined on R.

Let $f(x) = \sin 3x + \cos x$, $g(x) = \cos 3x + \sin x$ and

$h(x) = f^2(x) + g^2(x)$

Q. General solution of the equation $h(x) = 4$, is :

[where $n \in I$]

A. $\dfrac{\pi}{8}$

B. $\dfrac{\pi}{4}$

C. $\dfrac{\pi}{6}$

D. $\dfrac{\pi}{2}$

Answer: B

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2. Consider f, g and h be three real valued function defined on R.

Let $f(x) = \sin 3x + \cos x$, $g(x) = \cos 3x + \sin x$ and

$h(x) = f^2(x) + g^2(x)$

Q. General solution of the equation $h(x) = 4$, is :

[where $n \in I$]

A. $(4n + 1)\dfrac{\pi}{8}$

B. $(8n + 1)\dfrac{\pi}{8}$

C. $(2n + 1)\dfrac{\pi}{4}$

D. $(7n + 1)\dfrac{\pi}{4}$

Answer: A

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3. Consider f, g and h be three real valued function defined on R. Let

$f(x) = \sin 3x + \cos x,\ g(x) = \cos 3x + \sin x$ and

$h(x) = f^2(x) + g^2(x)$. Then,

Number of point (s) where the graphs of the two function, y=f(x) and y=g(x) intersects in $[0, \pi]$, is

A. 2

B. 3

C. 4

D. 5

Answer: C

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1. Find the number of solutions of the equations

$$(\sin x - 1)^3 + (\cos x - 1)^3 + (\sin x)^3 = (2 \sin x + \cos x - 2)^3 \qquad \text{in}$$

$(0, 2\pi)$.

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2. If $x + \sin y = 2014$ and $x + 2014 \cos y = 2013, 0 \le y \le \dfrac{\pi}{2}$, then find

the value of $[x + y] - 2005$

(where [.] denotes greatest integer function)

3. The complete set of values of x satisfying $\dfrac{2\sin 6x}{\sin x - 1} < 0$ and $\sec^2 x - 2\sqrt{2}\tan x \leq 0$ in $\left(0, \dfrac{\pi}{2}\right)$ is $[a, b) \cup (c, d)$, then find the value of $\left(\dfrac{cd}{ab}\right)$.

4. The range of value's of k for which the equation $2\cos^4 x - \sin^4 x + k = 0$ has atleast one solution is $[\lambda, \mu]$. Find the value of $(9\mu + \lambda)$.

5. Find the coodinates of the point of intersection of the curves $y = \cos x, y = \sin 3x$ if $-\dfrac{\pi}{2} \leq x \leq \dfrac{\pi}{2}$

6. Find the number of solutions of the equation $2\sin^2 x + \sin^2 2x = 2, \sin 2x + \cos 2x = \tan x$ in $[0, 4\pi]$ satisfying the condition $2\cos^2 x + \sin x \le 2$.

7. If the sum of all the solutions of the equation $3\cot^2 \theta + 10\cot \theta + 3 = 0$ in $[0, 2\pi]$ is $k\pi$ where $k \in I$, then find the value of k .

8. If the sum of all values of $\theta, 0 \le \theta \le 2\pi$ satisfying the equation $(8\cos 4\theta - 3)(\cot \theta + \tan \theta - 2)(\cot \theta + \tan \theta + 2) = 12$ is $k\pi$, then k is equal to :

A. 2

B. 4

C. 12

D. 8

Answer: D

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9. Find the number of solutions of the equation $2\sin^2 x + \sin^2 2x = 2$, $\sin 2x + \cos 2x = \tan x$ in $[0, 4\pi]$ satisfying the condition $2\cos^2 x + \sin x \le 2$.

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