MATHS

BOOKS - VK JAISWAL MATHS (HINGLISH)

TRIGONOMETRIC EQUATIONS

Exercise 1 Single Choice Problems

1. Let x and y be 2 real numbers which satisfy the equations $\left(\tan^2 x - \sec^2 y\right) = \frac{5a}{6} - 3$ 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. $-\frac{2}{3}$

C. -1

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

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

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

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

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

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

Answer: D

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4. The number of solutions of the equation $\left(2\sin\left(\frac{\sin x}{2}\right)\right)\left(\cos\left(\frac{\sin x}{2}\right)\right)\left(\sin\left(2\tan\frac{x}{2}\ \cos^2\frac{x}{2}\right) - 3\right) + 2 = 0$ 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 $0 < \theta < 360^\circ$ is :

A. 1

B. 2

C. 3

D. 4

Answer: D

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

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9. The general value of x satisfying the equation

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

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

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

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

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

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. $x = \frac{n\pi}{2}$

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

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

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

Answer: C

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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. $\frac{\pi}{4}$

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

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

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

Answer: A

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

A. 0

B. 2

C. 3

D. 7

Answer: C

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

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

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

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

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

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 $\sin x - \cos x = 1$ is (where $n \in I$) :

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

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

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

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 $4\sin^2 x + \tan^2 x + \cot^2 x + \text{cosec}^2 x = 6$ in $[0, 2\pi]$

A. 1

B. 2

C. 3

D. 4

Answer: D

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18. The number of solutions of the equation $\sin^4 \theta - 2\sin^2 \theta + 1 = 0$ which lie between 0 and 2π is :

A. 0

B. 2

C. 4

D. 8

Answer: A

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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. $\frac{\pi}{\sqrt{2}}$

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

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

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

Answer: C

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20. The total number of ordered pairs (x, y) satisfying $|x| + |y| = 2$ and $\sin\left(\frac{\pi x^2}{3}\right) = 1$ is :

A. 2

B. 4

C. 6

D. 8

Answer: B

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

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

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

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

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

Answer: D

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22. The general solution of the equation $\sin^4 x + \cos^4 x = \sin x \cos x$ is

A. 2

B. 4

C. 6

D. 8

Answer: A

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

A. 1

B. 2

C. 0

D. Infinite

Answer: C

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

A. No solution

B. One solution

C. Two solution

D. Infinite solution

Answer: B

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

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

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

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

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

Answer: D

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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. $\cos\theta = \frac{1}{\sqrt{2}}$

B. $\tan\theta = 1$

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

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

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

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

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

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

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4. The least difference between the roots, in the first quadrant $\left(0 \leq x \leq \frac{\pi}{2}\right)$, of the equation $4\cos x\left(2 - 3\sin^2 x\right) + (\cos 2x + 1) = 0$, is

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

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

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

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

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 $\left[\frac{\pi}{2}, \pi\right]$

Answer: A::C::D

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6. Identify the correct option

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

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

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

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

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

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

A. $k = 0$

B. $|k| \leq \frac{1}{2}$

C. $-\frac{3}{2} \leq k \leq \frac{1}{2}$

D. $-\frac{1}{2} \leq k \leq \frac{3}{2}$

Answer: A::B::C

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8. Let $f(\theta) = \left(\cos\theta - \cos\frac{\pi}{8}\right)\left(\cos\theta - \cos\frac{3\pi}{8}\right)\left(\cos\theta - \cos\frac{5\pi}{8}\right)\left(\cos\theta - \cos\frac{7\pi}{8}\right)$ then :

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

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

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

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

Answer: B::C::D

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9. If $\frac{\sin^2 2x + 4\sin^4 x - 4\sin^2 x \cdot \cos^2 x}{4 - \sin^2 2x - 4\sin^2 x} = \frac{1}{9}$ and $0 < x < \pi$. Then the value of x is :

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

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

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

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

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. $\frac{\pi}{4}$

B. π

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

D. None of these

Answer: C

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11. $\sin\theta + \sqrt{3}\cos\theta = 6x - x^2 - 11, 0 \leq 4\theta\pi, x \in R,$ hold for no values of $xandth\eta\ onevalueof$ x and two values of θ two values of x and two values of θ two point of values of (x, θ)

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

The length of a longest interval in which the function g=h(x) is increasing, is

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

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

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

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

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

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

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

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

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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Exercise 4 Matching Type Problems

1.

	Column-I		Column-II
(A)	If $\sin x + \cos x = \frac{1}{5}$; then $\lvert 12 \tan x \rvert$ is equal to	(P)	2
(B)	Number of values of θ lying in $(-2\pi, \pi)$ and satisfying $\cot\frac{\theta}{2} = (1 + \cot\theta)$ is	(Q)	6
(C)	If $2 - \sin^4 x + 8\sin^2 x = \alpha$ has solution, then α can be	(R)	9
(D)	Number of integral values of x satisfying $\log_4(2x^2 + 5x + 27) - \log_2(2x - 1) \geq 0$	(S)	14
		(T)	16

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2.

	Column-I		Column-II
(A)	If $x, y \in [0, 2\pi]$, then total number of ordered pair (x, y) satisfying $\sin x \cos y = 1$ is	(P)	4
(B)	If $f(x) = \sin x - \cos x - kx + b$ decreases for all real values of x, then $2\sqrt{2}k$ may be	(Q)	0
(C)	The number of solution of the equation $\sin^{-1}(\lvert x^2 - 1\rvert) + \cos^{-1}(\lvert 2x^2 - 5\rvert) = \frac{\pi}{2}$ is	(R)	2
(D)	The number of ordered pair (x, y) satisfying the equation $\sin x + \sin y = \sin(x + y)$ and $\lvert x\rvert + \lvert y\rvert = 1$ is	(S)	3
		(T)	6

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3.

	Column-I		Column-II
(A)	Minimum value of $y = 4\sec^2 x + \cos^2 x$ for permissible real values of x is equal to	(P)	2
(B)	If m, n are positive integers and $m + n\sqrt{2} = \sqrt{41 + 24\sqrt{2}}$ then $(m + n)$ is equal to :	(Q)	7
(C)	Number of solutions of the equation : $\log_{\left(\frac{9x-x^2-14}{7}\right)}(\sin 3x - \sin x) = \log_{\left(\frac{9x-x^2-14}{7}\right)} \cos 2x$ is equal to :	(R)	4
(D)	Consider an arithmetic sequence of positive integers. If the sum of the first ten terms is equal to the 58th term, then the least possible value of the first term is equal to :	(S)	5
		(T)	3

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Exercise 5 Subjective Type Problems

1. Find the number of solutions of the equations

$(\sin x - 1)^3 + (\cos x - 1)^3 + (\sin x)^3 = (2\sin x + \cos x - 2)^3$ in $[0, 2\pi]$.

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2. If $x + \sin y = 2014$ and $x + 2014\cos y = 2013, 0 \leq y \leq \frac{\pi}{2}$, then find the value of $[x + y] - 2005$

(where [.] denotes greatest integer function)

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

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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 $(9\mu + \lambda)$.

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5. The number of points in interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, where the graphs of the curves $y = \cos x$ and $y = \sin 3x$, $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ intersects is

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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 $2\cos^2 x + \sin x \leq 2$.

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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.

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8. If the sum of all values of $\theta, 0 \leq \theta \leq 2\pi$ 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 :

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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 $2\cos^2 x + \sin x \leq 2$.

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