MATHS

BOOKS - SHRI BALAJI MATHS (ENGLISH)

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 in interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is 0 (b) 5 (c) 6 (d) 10

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 solution of $4\sin^2 x + \tan^2 x + \cos ec^2 x + \cot^2 x - 6 = 0 is (n \in Z)$ (a) $n\pi \pm \frac{\pi}{4}$ (b) $2n\pi \pm \frac{\pi}{4}$ $n\pi + \frac{\pi}{3}$ (d) $n\pi - \frac{\pi}{6}$

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 $\sin^{100} x - \cos^{100} x = 1$ is (a) $2n\pi + \frac{\pi}{3}, n \in I$ (b) $n\pi + \frac{\pi}{2}, n \in I$ (c) $n\pi + \frac{\pi}{4}, n \in I$ (d) $2n\pi = \frac{\pi}{3}, n \in I$

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

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

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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 when $x \in [0, 2\pi]$.

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 $|x| + |y| = 2, \sin(\pi x^2/3) = 1$, is equal to

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. about to only mathematics

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 interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, the equation $\log_{\sin\theta}\left(\cos^2\theta\right) = 2$ 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 roots of the equation $a\cos\theta + b\sin\theta = c$, then find the value of $\tan(\alpha+\beta)$.

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

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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: B

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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 =

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 options :

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. Solve $\frac{\sin^2 2x + 4\sin^4 x - 4\sin^2 x \cos^2 x}{4 - \sin^2 2x - 4\sin^2 x} = \frac{1}{9}$.

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

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 $h(x) = f^2(x) + g^2(x)$. h(x) = 4

A. 2

B. 3

C. 4

D. 5

Answer: C

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Exercise 4 Matching Type Problems

1. Match the following Column I to Column II

	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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2.

	Column-I		Column-II
(A)	Exact value of $\cos 40^\circ(1-2\sin 10^\circ) =$	(P)	$\frac{1}{4}$

(B)	Value of λ for which lines are concurrent $x+y+1=0,\ 3x+2\lambda y+4=0,\ x+y-3\lambda=0$ can be	(Q)	$\frac{1}{2}$
(C)	Points $(k, 2-2k), (-k+1, 2k)$ and $(-4-k, 6-2k)$ are collinear then sum of all possible real values of 'k' is	(R)	$\frac{3}{2}$
(D)	Value of $\sum_{k=3}^{\infty} \sin^k\left(\frac{\pi}{6}\right) =$	(S)	$-\frac{1}{2}$

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

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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 :

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

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