

TRI

LEVEL-I

1. If $\sin\theta + \operatorname{cosec}\theta = 2$, then the value of $\sin^n\theta + \operatorname{cosec}^n\theta$, $n \geq 2$, $n \in \mathbb{N}$ equals
(A) 2 (B) 2^n
(C) 1 (D) none of these
2. The maximum value of $1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2 \cos\left(\frac{\pi}{4} - \theta\right)$, $\theta \in \mathbb{R}$, equals
(A) 3 (B) 5
(C) 4 (D) none of these
3. The least value of $\cos^2\theta - 6 \sin\theta \cos\theta + 3 \sin^2\theta + 2$ is
(A) $4 + \sqrt{10}$ (B) $4 - \sqrt{10}$
(C) 0 (D) none of these
4. If $0 < \beta < \alpha \leq \frac{\pi}{4}$, $\cos(\alpha + \beta) = \frac{3}{5}$ and $\cos(\alpha - \beta) = \frac{4}{5}$, then $\sin 2\alpha$ is equals
(A) 1 (B) 0
(C) 2 (D) none of these
5. The numerical value of $\sin \frac{\pi}{18} \cdot \sin \frac{5\pi}{18} \cdot \sin \frac{7\pi}{18}$ is equal to
(A) 1 (B) $\frac{1}{8}$
(C) $\frac{1}{4}$ (D) none of these
6. If $\tan\theta \cdot \tan\left(\frac{\pi}{3} + \theta\right) \cdot \tan\left(\frac{\pi}{3} - \theta\right) = -1$, ($0 < \theta < \pi/2$), then value of $3 \sin\theta - 4 \cos^3\theta =$
(A) 1 (B) -1
(C) $1/\sqrt{2}$ (D) $-1/\sqrt{2}$
7. If in a $\triangle ABC$, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is
(A) isosceles triangle (B) right angled triangle (C) acute angle triangle
(D) obtuse angled triangle
8. Minimum value of the expression $2 \sin x + 4 \cos x + 3\sqrt{5}$ is
(A) $5\sqrt{5}$ (B) $2\sqrt{5} + 3$ (C) $2\sqrt{5} - 3$ (D) none of these
9. The maximum value of $4 \sin^2 x + 3 \cos^2 x + \sin x/2 + \cos x/2$ is
(A) $4 + \sqrt{2}$ (B) $3 + \sqrt{2}$ (C) 9 (D) 4
10. If $\tan \theta = \frac{1}{2}$, $\tan \phi = \frac{1}{3}$, then $\theta + \phi =$ _____
(A) 0 (B) $\pi/2$
(C) $\pi/4$ (D) π

11. The value of $\tan 15^\circ =$ _____
12. If $2 \sin \theta \cdot \sec 3\theta = \tan 3\theta - \tan \theta$, then $2[\sin \theta \cdot \sec 3\theta + \sin 3\theta \cdot \sec 3^2\theta + \dots + \sin 3^{n-1}\theta \cdot \sec 3^n\theta] =$ _____
13. If $\tan \theta = \frac{b}{a}$, then $a \cos 2\theta + b \sin 2\theta =$ _____
14. Maximum value of $2 \cos \theta + 3 \sin \theta + 4$ is _____
15. If $\sec \theta - \tan \theta = 5$, then $\sec \theta =$ _____
16. If $\pi < 2\theta < \frac{3\pi}{2}$, then $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$ equals to
 (A) $-2 \cos \theta$ (B) $-2 \sin \theta$ (C) $2 \cos \theta$ (D) $2 \sin \theta$
17. If $\tan \theta = \sqrt{n}$ for some non-square natural number n then $\sec 2\theta$ is
 (A) a rational number (B) an irrational number
 (C) a positive number (D) none of these.
18. If α and β are two distinct roots of the equation $a \tan x + b \sec x = c$, then $\tan(\alpha + \beta)$ is equal to
 (A) $\frac{a^2 - c^2}{a^2 + c^2}$ (B) $\frac{a^2 + c^2}{a^2 - c^2}$ (C) $\frac{2ac}{a^2 + c^2}$ (D) $\frac{2ac}{a^2 - c^2}$
19. If $\sin \theta = 3 \sin(\theta + 2\alpha)$ then value of $\tan(\theta + \alpha) + 2 \tan \alpha$ is
 (A) 3 (B) 2 (C) 1 (D) 0
20. In a $\triangle ABC$, if $\cot A \cot B \cot C > 0$, then the Δ is
 (A) acute angled (B) right angled
 (C) obtuse angled (D) does not exist
21. If $\sin x = \cos^2 x$, then $\cos^2 x (1 + \cos^2 x)$ equals to
 (A) 0 (B) 1
 (C) 2 (D) none of these
22. The value of $\sin 15^\circ =$ _____
23. Maximum value of $2 \cos \theta + 3 \sin \theta + 5 =$ _____
24. If $\sin \alpha \sin \beta - \cos \alpha \cos \beta = 1$, then $\tan \alpha + \tan \beta =$ _____
25. If $\tan \theta = \frac{x}{y}$, then $x \cos 2\theta + y \sin 2\theta =$ _____
26. The value of $\cos 10^\circ - \sin 10^\circ$ is
 (A) positive (B) negative
 (C) 0 (D) 1

27. $\frac{\tan 69^\circ + \tan 66^\circ}{1 - \tan 69^\circ \tan 66^\circ} =$
 (A) 1 (B) -1
 (C) 0 (D) none of these
28. The value of $\sin 12^\circ \sin 28^\circ \sin 54^\circ =$ _____
29. If $\sin \alpha \sin \beta - \cos \alpha \cos \beta + 1 = 0$, then $1 + \cot \alpha \tan \beta =$ _____
30. The equation $\sin^2 \theta = \frac{x^2 + y^2}{2xy}$ is possible if
 (A) $x = y$ (B) $x = -y$
 (C) $2x = y$ (D) none of these
31. $\sqrt{3} \sin x + \cos x$ is maximum when x is
 (A) 30° (B) 45°
 (C) 60° (D) 90°
32. The minimum value of $3\tan^2\theta + 12 \cot^2\theta$ is
 (A) 6 (B) 15
 (C) 24 (D) none of these .
33. If $\frac{\tan 3\theta}{\tan \theta} = 4$, then $\frac{\sin 3\theta}{\sin \theta}$ equals
 (A) $3/5$ (B) $4/5$
 (C) $3/4$ (D) none of these.
34. For any real θ , the maximum value of $\cos^2(\cos\theta) + \sin^2(\sin\theta)$
 (A) is 1 (B) is $1 + \sin^2 1$
 (C) is $1 + \cos^2 1$ (D) does not exist
35. If $\operatorname{cosec} A + \cot A = 11/2$, then $\tan A$ is equal to
 (A) $111/44$ (B) $44/117$
 (C) $44/125$ (D) $117/125$
36. If in $\triangle ABC$, $\angle A = \sin^{-1}(x)$, $\angle B = \sin^{-1}(y)$ and $\angle C = \sin^{-1}(z)$, then $x\sqrt{1-y^2}\sqrt{1-z^2} + y\sqrt{1-x^2}\sqrt{1-z^2} + z\sqrt{1-x^2}\sqrt{1-y^2}$ is equal to
 (A) xyz (B) $x+y+z$
 (C) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ (D) None of these
37. If $T_n = \sin^n \theta + \cos^n \theta$, then $\frac{T_6 - T_4}{T_6} = m$ holds for values of m satisfying
 (A) $m \in \left[-1, \frac{1}{3}\right]$ (B) $m \in \left[0, \frac{1}{3}\right]$
 (C) $m \in [-1, 0]$ (D) None of these
38. If $4 \sin A + \sec A = 0$ then $\tan A$ equals to
 (A) $4 \pm \sqrt{2}$ (B) $-2 \pm \sqrt{3}$
 (C) $2 \pm 4\sqrt{3}$ (D) $4 \pm 2\sqrt{3}$

39. Value of the expression $2\sin x - \cos 2x$ is always
 (A) greater than or equal to $-3/2$ (B) less than or equal to $3/2$
 (C) greater than or equal to $-1/2$ (D) none of these
40. If $\cos 25^\circ + \sin 25^\circ = k$, then $\cos 20^\circ$ is equal to
 (A) $\frac{k}{\sqrt{2}}$ (B) $-\frac{k}{\sqrt{2}}$
 (C) $\pm \frac{k}{\sqrt{2}}$ (D) None of these
41. If $2n\alpha = \pi/2$, then $\tan \alpha \tan 2\alpha \tan 3\alpha \dots \tan (2n-1)\alpha$ is equal to
 (A) 1 (B) -1
 (C) 0 (D) None of these
42. If $-2 < \cos \theta + \sec \theta \leq 2$, then $\cos^n \theta + \sec^n \theta$ is equal to ($n \in \mathbb{N}$)
 (A) 2 (B) 2^n
 (C) 0 (D) None of these.
43. If $\tan \theta = n \tan \phi$, then maximum value of $\tan^2 (\theta - \phi)$ is equal to
 (A) $\frac{(n-1)^2}{4n}$ (B) $\frac{(n+1)^2}{4n}$
 (C) $\frac{(n+1)}{2n}$ (D) $\frac{(n-1)}{2n}$
44. If $\cos \theta - \sin \theta = \sqrt{2} \sin \theta$; Then the value of $\cos \theta + \sin \theta$ is equal to;
 (A) $\sqrt{2} \cos \theta$ (B) $-\sqrt{2} \cos \theta$
 (C) $-\sqrt{2} \cos \theta$ (D) none of these
45. If $\sec^2 \theta = \frac{4xy}{(x+y)^2}$, then x and y ;
 (A) are always equal (B) can be any real number
 (C) can assume finite number (D) none of these.
46. If $\cos x + \sec x = -2$, then for a positive integer n , $\cos^n x + \sec^n x$ is
 (A) always 2 (B) always -2
 (C) 2, if n is odd (D) 2, if n is even
47. If $|\sin x + \cos x| = |\sin x| + |\cos x|$, then x belongs to the quadrant
 (A) I or III (B) II or IV
 (C) I or II (D) III or IV
48. $\sin x + \cos x = y^2 - y + a$ has no value of x for any y if 'a' belongs to
 (A) $(0, \sqrt{3})$ (B) $(-\sqrt{3}, 0)$
 (C) $(-\infty, -\sqrt{3})$ (D) $(\sqrt{3}, \infty)$
49. If $\tan A + \cot A = 4$, then $\tan^4 A + \cot^4 A$ is equal to
 (A) 110 (B) 191
 (C) 80 (D) 194
50. $\cos^2 \frac{\pi}{12} + \cos^2 \frac{\pi}{4} + \cos^2 \frac{5\pi}{12}$ is

(A) $\frac{2}{3 + \sqrt{3}}$

(B) $\frac{2}{3}$

(C) $\frac{3 + \sqrt{3}}{2}$

(D) $\frac{3}{2}$

51. If A lies in the second quadrant and $3 \tan A + 4 = 0$ then the value of $2 \cot A - 5 \cos A + \sin A$ is equal to

(A) $\frac{37}{10}$

(B) $\frac{23}{10}$

(C) $-\frac{53}{10}$

(D) none of these

52. The minimum value of $\sec^2 \theta + \cos^2 \theta$ is

(A) 1

(B) 0

(C) 2

(D) none of these

53. If $\sin \alpha = p$ then the equation whose solution is $\tan \frac{\alpha}{2}$ is

(A) $px^2 + 2xp - 1 = 0$

(B) $px^2 + 2x - p = 0$

(B) $x^2 + 2x - p = 0$

(D) None of these

LEVEL-II

1. $\sin^2 \theta = \frac{(x+y)^2}{4xy}$, where $x, y \in \mathbb{R}$, gives real θ if and only if

(A) $x + y = 0$

(B) $x = y$

(C) $|x| = |y| \neq 0$

(D) none of these

2. Let $a = \cos A + \cos B - \cos(A + B)$ and $b = 4 \sin \frac{A}{2} \cdot \sin \frac{B}{2} \cdot \cos \frac{A+B}{2}$. Then $a - b$ is equal to

(A) 1

(B) 0

(C) -1

(D) none of these

3. If $3 \sin \theta + 4 \cos \theta = 5$, then $4 \sin \theta - 3 \cos \theta$ is equal to

(A) 0

(B) 5

(C) 1

(D) none of these

4. If in $\triangle ABC$ $\angle C = 90^\circ$, then the maximum value of $\sin A \sin B$ is

(A) $1/2$

(B) 1

(C) 2

(D) $3/4$

5. If θ lies in fourth quadrant, then $\sqrt{4 \cos^4 \theta + \sin^2 2\theta} + 4 \cos^2 \left(\frac{\pi}{2} + \frac{\theta}{2} \right)$ is equal to

(A) 1

(B) 2

(C) -2

(D) 0

6. If $(\alpha + \beta + \gamma + \delta) = \pi$ then $\sum \cos \alpha \cos \beta - \sum \sin \alpha \sin \beta =$

(A) 4

(B) 2

(C) 0

(D) none of these

7. If $x + y = 2\alpha$ then minimum value of $\sec x + \sec y$ is, $x, y \in \left(0, \frac{\pi}{2} \right)$

(A) $2 \cos \alpha$

(B) $\cos 2\alpha$

(C) $2 \sec \alpha$

(D) none of these

8. $\frac{\tan 70^\circ - \tan 20^\circ}{4 \tan 50^\circ} =$
 (A) 1 (B) $1/2$ (C) -1 (D) $-1/2$
9. In a triangle ABC maximum value of $\sin A + \sin B + \sin C$ is
 (A) $\frac{3\sqrt{3}}{2}$ (B) $\frac{2\sqrt{3}}{2}$ (C) $3\sqrt{3}$ (D) $\frac{\sqrt{3}}{2}$
10. If $1 + \sin \theta + \sin^2 \theta + \sin^3 \theta + \dots$ to $\infty = 4 + 2\sqrt{3}$, $0 < \theta < \pi$, $\theta \neq \pi/2$ then
 (A) $\theta = \frac{\pi}{6}$ (B) $\theta = \frac{\pi}{3}$ (C) $\theta = \frac{\pi}{6}$ or $\frac{\pi}{3}$ (D) $\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$
11. The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 89^\circ$ _____
12. Value of $\sin \frac{\pi}{9} \sin \frac{2\pi}{9} \sin \frac{3\pi}{9} \sin \frac{4\pi}{9}$ is _____
13. If $\sin x + \sin^2 x = 1$, then $\cos^{12} x + 3 \cos^{10} x + 3 \cos^8 x + \cos^6 x - 1 =$ _____
14. If $\sin(\alpha + \beta) = 1$, $\sin(\alpha - \beta) = \frac{1}{2}$ where $\alpha, \beta \in \left[0, \frac{\pi}{2}\right]$, then $\tan(\alpha + 2\beta) \tan(2\alpha + \beta)$ is _____
15. If in a $\triangle ABC$, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is
 (A) isosceles triangle (B) right angled triangle
 (C) acute angle triangle (D) obtuse angled triangle
16. If $\cot \theta + \tan \theta = x$ and $\sec \theta - \cos \theta = y$ then
 (A) $\sin \theta \cos \theta = 1/x$ (B) $\sin \theta \tan \theta = y$ (C) $(x^2 y)^{2/3} - (xy^2)^{2/3} = 1$ (D) $(x^2 y)^{2/3} + (xy^2)^{2/3} = 1$
17. The minimum value of $\cos(\cos x)$ is
 (A) 0 (B) $-\cos 1$
 (C) $\cos 1$ (D) -1
18. If $\sin \alpha$, $\sin \beta$ and $\cos \alpha$ are in G.P, then roots of the equation $x^2 + 2x \cot \beta + 1 = 0$ are always.
 (A) equal (B) real
 (C) imaginary (D) greater than 1
19. If $A + B = 45^\circ$, then $(1 + \tan A)(1 + \tan B) =$ _____
20. If $\sin \theta$, $\cos \theta$, $\tan \theta$ are in G.P, then $\cot^6 \theta - \cot^2 \theta$ is
 (A) 1 (B) -1
 (C) 0 (D) 2
21. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2 \cos^6 x + \cos^4 x$ is

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

22. If $\tan \beta = \frac{2 \sin \alpha \sin \gamma}{\sin(\alpha + \gamma)}$ then $\cot \alpha, \cot \beta, \cot \gamma$ are in
(A) AP (B) GP
(C) HP (D) none of these
23. If $\tan^2 \theta = 2 \tan^2 \phi + 1$, then $\cos 2\theta + \sin^2 \phi =$
(A) 1 (B) 2
(C) 0 (D) -1
24. The value of expression $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ$ is equal to
(A) 2 (B) 4
(C) $\frac{2 \sin 20^\circ}{\sin 40^\circ}$ (D) $\frac{4 \sin 20^\circ}{\sin 40^\circ}$
25. If $\sin x + \cos x + \tan x + \cot x + \sec x + \operatorname{cosec} x = 7$ and $\sin 2x = a - b\sqrt{7}$, then ordered pair (a, b) can be,
(A) (6, 2) (B) (8, 3)
(C) (22, 8) (D) (11, 4)
26. If $\tan x - \tan^2 x = 1$, then the value of $\tan^4 x - 2 \tan^3 x - \tan^2 x + 2 \tan x + 1$ is
(A) 1 (B) 2
(C) 3 (D) 4
27. The minimum value of the expression $3^{\sin^6 x} + 3^{\cos^6 x}$ is
(A) $2.3^{1/8}$ (B) $2.3^{7/8}$
(C) $3.2^{1/8}$ (D) None of these
28. If $\sin \theta + \sin \phi = \sqrt{3} (\cos \phi - \cos \theta)$, then $\sin 3\theta + \sin 3\phi$ is equal to
(A) $\sqrt{3}$ (B) 0
(C) 1 (D) None of these
29. The minimum value of $(a \sec \theta - b \tan \theta)^2$, $|a| < |b|$, is
(A) 0 (B) $a^2 + b^2$
(C) ab (D) $(1/2)(a^2 + b^2)$
30. If $\tan x + \tan^2 x + \tan^3 x = 1$ then the value of $2 \cos^6 x - 2 \cos^4 x + \cos^2 x$ equals to
(A) $1/2$ (B) 2
(C) 1 (D) none of these
31. If $a \leq 16 \sin x \cos x + 12 \cos^2 x - 6 \leq b$ for all $x \in \mathbb{R}$ then
(A) $a = -5, b = 5$ (B) $a = -4, b = 4$
(C) $a = -10, b = 10$ (D) none of these
32. If $k \sin^2 x + \frac{1}{k} \operatorname{cosec}^2 x = 2$, $x \in (0, \pi/2)$, then $\cos^2 x + 5 \sin x \cos x + 6 \sin^2 x$ is equal to
(A) $\frac{k^2 + 5k + 6}{k^2}$ (B) $\frac{k^2 - 5k + 6}{k^2}$
(C) 6 (D) none of these

33. Value of $\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8}$ is equal to;
 (A) $\frac{3}{2}$ (B) $\frac{2}{3}$
 (C) $\sqrt{3/2}$ (D) $\sqrt{2/3}$

34. The minimum value of $\frac{1}{-2 \sin x - 2\sqrt{3} \cos x + 6}$ is equal to
 (A) $-\frac{1}{10}$ (B) $-\frac{1}{\sqrt{3}}$
 (C) $\frac{1}{10}$ (D) $\frac{1}{6}$

LEVEL-III

- In a ΔABC , $\cos 2A + 4 \cos(B + C) \sin B \sin C$ is equal to
 (A) $2 \cos^2 A + \cos 2B$ (B) $\cos 2B - 2 \sin^2 A$
 (C) $\cos^2 B + 2 \cos A$ (D) none of these
- The value of $\cot^2 36^\circ \cot^2 72^\circ$ is
 (A) $1/2$ (B) $1/3$
 (C) $1/4$ (D) $1/5$
- If $x = \alpha, \beta$ satisfy both the equations $a \cos^2 x + b \cos x + 1 = 0$ and $a \sin^2 x + p \sin x + 1 = 0$, then
 (A) $2a(a+2) = b^2 - p^2$ (B) $2a(a-2) = b^2 + p^2$
 (C) $2a(a+2) = b^2 + p^2$ (D) None of these
- The number of points inside or on the circle $x^2 + y^2 = 4$ satisfying $\tan^4 x + \cot^4 x + 1 = 3 \sin^2 y$ is
 (A) one (B) two
 (C) four (D) infinite
- The number of ordered 4-tuple (x, y, z, w) ($x, y, z, w \in [0, 10]$) which satisfied the inequality, $2^{\sin^2 x} 3^{\cos^2 y} 4^{\sin^2 z} 5^{\cos^2 w} \geq 120$ is
 (A) 0 (B) 144
 (C) 81 (D) infinite
- If all the solutions 'x' of $a^{\cos x} + a^{-\cos x} = 6$ ($a > 1$) are real, then set of values of a is
 (A) $[3+2\sqrt{2}, \infty)$ (B) $(6, 12)$
 (C) $(1, 3+2\sqrt{2})$ (D) none of these.
- A quadrilateral ABCD is circumscribed about a circle, then
 (A) $AB \cdot \sin \frac{A}{2} \cdot \sin \frac{B}{2} = CD \cdot \sin \frac{C}{2} \cdot \sin \frac{D}{2}$ (B) $AB \cdot \sin \frac{C}{2} \cdot \sin \frac{A}{2} = CD \cdot \sin \frac{B}{2} \cdot \sin \frac{D}{2}$
 (C) $AB \cdot \sin \frac{A}{2} \cdot \sin \frac{D}{2} = CD \cdot \sin \frac{B}{2} \cdot \sin \frac{C}{2}$ (D) None of these.

ANSWERS

LEVEL -I

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|---------------------------------------|-------------------------------|--------------------|-------------------------------------|
| 1. A | 2. C | 3. B | 4. A |
| 5. B | 6. C | 7. C | 8. D |
| 9. A | 10. C | 11. $2 - \sqrt{3}$ | 12. $\tan 3^n \theta - \tan \theta$ |
| 13. A | 14. $\sqrt{13} + 4$ | 15. $\frac{13}{5}$ | 16. A |
| 17. A | 18. D | 19. D | 20. A |
| 21. D | 22. $\sqrt{3} - 1$ | | |
| 23. $\sqrt{13} + 5$ | 24. 0 | | |
| 25. $\frac{x(3y^2 - x^2)}{x^2 + y^2}$ | 26. A | | |
| 27. B | 28. $\frac{\sin 18^\circ}{4}$ | | |
| 29. 0 | 30. A | 31. C | 32. D |
| 33. D | 34. B | 35. B | 36. A |
| 37. C | 38. B | 39. A | 40. A |
| 41. A | 42. A | 43. A | 44. A |
| 45. A | 46. D | 47. A | 48. D |
| 49. D | 50. D | 51. B | |
| 52. C | 53. D | | |

LEVEL -II

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|-------|-------|-------|--------------------|
| 1. C | 2. A | 3. B | 4. A |
| 5. B | 6. C | 7. C | 8. B |
| 9. A | 10. D | 11. 1 | 12. $\frac{3}{16}$ |
| 13. 0 | 14. 1 | 15. B | 16. C |
| 17. C | 18. B | 19. 2 | 20. A |
| 21. D | 22. A | 23. C | 24. B |
| 25. C | 26. D | 27. A | 28. B |
| 29. A | 30. A | 31. C | 32. D |
| 33. A | 34. C | | |

LEVEL -III

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|------|------|------|------|
| 1. D | 2. D | 3. C | 4. C |
| 5. B | 6. A | 7. A | |