TOPICS COVERED

TRIGONOMETRICAL RATIOS, IDENTITIES AND EQUATIONS

1. $\cos(540°-\theta)-\sin(630°-\theta)$ is equal to

(1) 0 (2) $2\cos\theta$

(3) $2\sin\theta$ (4) $\sin\theta-\cos\theta$

2. $2\sec^2+\alpha-2\cos ec^2\alpha+\cos ec^4\alpha=15/4$ if $\tan\alpha$ is equal to

(1) $1/\sqrt{2}$ (2) 1/2

(3) $1/2\sqrt{2}$ (4) 1/4

3. If $\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}=x$, then $\frac{\cos\alpha}{1+\sin\alpha}$ is equal to

(1) $1/x$ (2) x

(3) $1+x$ (4) $1-x$

4. If $\cos\alpha=\frac{2\cos\beta-1}{2-\cos\beta}(0>\alpha,\beta<\pi)$, $\alpha+\beta=\pi$ then $\tan(\alpha/2)$ is equal to

(1) $3^{1/4}$ (2) $3^{1/2}$

(3) 3 (4) 3^2

5. If $\tan 25°=x$, then $\frac{\tan 155°-\tan 115°}{1+\tan 155°\tan 115°}$ is equal to

(1) $\frac{1-x^2}{2x}$ (2) $\frac{1+x^2}{2x}$

(3) $\frac{1+x^2}{1-x^2}$ (4) $\frac{1-x^2}{1+x^2}$

6. If $\sin x+\cos y=a$ and $\cos x+\sin b$, then $\tan\frac{x-y}{2}$ is equal to

(1) $a+b$ (2) $a-b$

(3) $\frac{a+b}{a-b}$ (4) $\frac{a-b}{a+b}$

7. The value of the determinant

$$\begin{vmatrix} \sin^2 13° & \sin^2 77° & \tan 135° \\ \sin^2 77° & \tan 135° & \sin^2 13° \\ \tan 135° & \sin^2 13° & \sin^2 77° \end{vmatrix}$$ is equa to

(1) – 1 (2) 0

(3) 1 (4) 2

8. If A = 130° and x = sin A + cos A, then

(1) $x > 0$ (2) $x < 0$

(3) $x = 0$ (4) $x \geq 0$

9. If $\tan^2 36°+k(\sin 18°+\cos 36°)=5$, then the value of k is

(1) 2 (2) $2\sqrt{5}$

(3) 4 (4) $4\sqrt{5}$

10. $\frac{\sin 3\alpha}{\cos 2\alpha}<0$ if α lies in

(1) $(13\pi/48, 14\pi/48)$

(2) $(14\pi/48, 18\pi/48)$

(3) $(18\pi/48, 23\pi/48)$

(4) any of these intervals

11. If $\cos\alpha+\cos\beta=a$, $\sin\alpha+\sin\beta=b$ and θ is the arithmetic mean between α and β then $\sin 2\theta+\cos 2\theta$ is equal to

(1) $(a+b)^2/(a^2+b^2)$

(2) $(a-b)^2/(a^2+b^2)$

(3) $(a^2-b^2)/(a^2+b^2)$

(4) none of these

12. If $\frac{\sin x}{a}=\frac{\cos x}{b}=\frac{\tan x}{c}=k$, then

$bc+\frac{1}{ck}+\frac{ak}{1+bk}$ is equal to

(1) $k\left(a+\frac{1}{a}\right)$ (2) $\frac{1}{k}\left(a+\frac{1}{a}\right)$

(3) $\frac{1}{k^2}$ (4) $\frac{a}{k}$

13. $\sin^2\alpha+\cos^2(\alpha+\beta)+2\sin\alpha\sin\beta\ (\alpha+\beta)$ is independent of

(1) α (2) β

(3) both α and β (4) none

14. If $u_n=\sin n\theta\sec^n\theta,\ v_n=\cos n\theta\sec^n\theta,$ $n\neq1,\theta\neq p\pi, n, p\in I,$ Then

$\frac{v_n-v_{n-1}}{u_{n-1}}+\frac{1u_n}{nc_n}=0$ for

(1) all values of n
(2) finite numbers of values of n
(3) infinite numbers of value of n
(4) no values of n

15. If $\frac{1}{\cos\alpha\cos\beta}+\tan\alpha\tan\beta=\tan\gamma,$ $0<\alpha,\beta<\pi$ then $1-\tan^2\gamma<0$ for

(1) all values of α and β
(2) no values of α and β
(3) finite number of values of α and β
(4) infinite number of values of α and β

16. tan 203° + tan 22° + tan 203° tan 22° =

(1) – 1 (2) 0
(3) 1 (4) 2

17. If sin 32° = k and cos x = 1 – 2k² ; α,β are the values of x between 0° and 360° with $\alpha<\beta$, then

(1) $\alpha+\beta=180°$ (2) $\beta-\alpha=200°$
(3) $\beta=4\alpha+40°$ (4) $\beta=5\alpha-20°$

18. The minimum value of $27\tan^2\theta+3\cot^2\theta$ is

(1) 9 (2) 18
(3) 27 (4) 30

19. The value of sin 12° sin 48° sin 54° is

(1) sin 30° (2) sin² 30°
(3) sin³ 30° (4) cos³ 30°

20. $\tan^5\frac{\pi}{9}-33\tan^4\frac{\pi}{9}+27\tan^2\frac{\pi}{9}=$

(1) $\tan\frac{\pi}{3}$ (2) $\tan^2\frac{\pi}{3}$

(3) $\tan\frac{\pi}{6}$ (4) $\tan^2\frac{\pi}{6}$

21. If $\sin\beta=\sin(2\alpha+\beta),$ then $\tan(a+\beta)-2\tan\alpha$ is

(1) independent of α
(2) independent of β
(3) independent of both α and β
(4) independent of none of them

22. Let n be afixed positive integer such that $\sin(\pi/2n)+\cos(\pi/2)=\sqrt{n}/2,$ then

(1) $n<4$ (2) $n>8$
(3) $n=6$ (4) none of these

23. If $A=\sin^2\theta+\cos^4\theta,$ then for all values of θ

(1) $1\le A\le2$ (2) $3/4\le A\le1$
(3) $13/16\le A\le1$ (4) $3/4\le A\le13/16$

24. If $a=\cos\phi\cos\psi+\sin\phi\sin\psi\cos\delta$
$b=\cos\phi\sin\psi-\sin\phi\cos\psi\cos\delta$ and
$c=\sin\phi\sin\delta.$ then $a^2+b^2+c^2=$

(1) – 1 (2) 0
(3) 1 (4) none of these

25. In a triangle ABC, BP is drawn perpendicular to BC to meet CA in P, such that $CA = AP$, then $\frac{BP}{AB}=$

(1) $2\sin A$ (2) $2\sin B$
(3) $2\sin C$ (4) none of these

26. If $x+y=z,$ then $\cos^2x+\cos^2y+\cos^2z-2\cos x\cos y\cos z$ is equal to

(1) $\cos^2z$ (2) $\sin^2z$
(3) 0 (4) 1

27. If $\sin 2\theta = k$, then the value of

$\frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^3\theta}{1+\cot^2\theta}$ is equal to

(1) $\frac{1-k^2}{k}$ (2) $\frac{2-k^2}{2}$

(3) k^2+1 (4) $2-k^2$

28. If $\sin^2 A = x$, then sin A Sin 2A Sin 3A sin 4A is a polynomial in *x*, the sum of whose co-efficients is

(1) 0 (2) 40

(3) 168 (4) 336

29. If $\frac{\sin A}{\sin B} = \frac{\sqrt{3}}{2}$ and $\frac{\cos A}{\cos B} = \frac{\sqrt{5}}{2}$, $0 < A, B < \pi/2$, then $\tan A + \tan B$ is equal to

(1) $\sqrt{3}\sqrt{5}$ (2) $\sqrt{5}\sqrt{3}$

(3) 1 (4) $\left(\sqrt{3}+\sqrt{5}\right)/\sqrt{5}$

30. If $\cos\theta = \cos\alpha\cos\beta$, then $\tan\frac{\theta+\alpha}{2}\tan\frac{\theta-\alpha}{2}$ is equal to

(1) $\tan^2(\alpha/2)$ (2) $\tan^2(\beta/2)$

(3) $\tan^2(\theta/2)$ (4) $\cot^2(\beta/2)$

31. If $\alpha, \beta, \gamma, \delta$ are the smallest positive angles in ascending order of magnitude which have their sines equal to the positive quantity *k*, then the values of $4\sin\frac{\alpha}{2} + 3\sin\frac{\beta}{2} + 2\sin\frac{\gamma}{2} + \sin\frac{\delta}{2}$ is equal to

(1) $2\sqrt{1-k}$ (2) $2\sqrt{1+k}$

(3) $2\sqrt{k}$ (4) none of these

32. The equation $a\sin x + b\cos x = c$, *where* $|c| > \sqrt{a^2+b^2}$ *has*

(1) a unique solution

(2) infinite number of solutions

(3) no solution

(4) none of these

33. If $\cot\alpha$ equals the integral solution of the inequality $4x^2 - 16x + 15 < 0$ and $\sin\beta$ equals to the slope of the bisector of the first quadrant, then $\sin(\alpha+\beta)\sin(\alpha-\beta)$ is equal to

(1) $-3/5$ (2) $-4/5$

(3) $2\sqrt{5}$ (4) 3

34. The value of $\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{6\pi}{7} + \cos\frac{7\pi}{7}$ is

(1) 1 (2) – 1

(3) 1/2 (4) – 3/2

35. The greatest value of $f(x) = 2\sin x + \sin 2x$ on $[0, 3\pi/2]$, is given by

(1) 9/2 (2) 5/2

(3) $3\sqrt{3}/2$ (4) 3/2

36. If $x = a\cos^3\theta\sin^2\theta$, $y = a\sin^3\theta\cos^2\theta$ and $\frac{(x^2+y^2)^p}{(xy)^q}(p, q, \in N)$ is independent of θ, then

(1) $4p = 5q$ (2) $4q = 5p$

(3) $p+q = 9$ (4) $pq = 20$

37. If $(a-b)\sin(\theta+\phi) = (a+b)\sin(\theta-\phi)$ and $a\tan(\theta/2) - b\tan(\phi/2) = c$, then the value of $\sin\phi$ is equal to

(1) $2ab/(a^2-b^2-c^2)$

(2) $2bc/(a^2-b^2-c^2)$

(3) $2bc/(a^2-b^2+c^2)$

(4) $2ab/(a^2-b^2+c^2)$

38. If $\frac{\cos x-\cos\alpha}{\cos x-\cos\beta}=\frac{\sin^2\alpha\cos\beta}{\sin^2\beta\cos\alpha}$ then cos *x* is equal to

(1) $\frac{\cos\alpha-\cos\beta}{1+\cos\alpha\cos\beta}$ (2) $\frac{\cos\alpha-\cos\beta}{1-\cos\alpha\cos\beta}$

(3) $\frac{\cos\alpha+\cos\beta}{1+\cos\alpha\cos\beta}$ (4) none of these

39. If $0<\alpha,\beta<\pi$ and $\cos\alpha+\cos\beta-\cos(\alpha+\beta)=3/2$ then $\sin\alpha+\cos\beta$ is equal to

(1) 0 (2) 1

(3) $(\sqrt{3}+1)/2$ (4) $\sqrt{3}$

40. If $\sin\theta,\cos\theta,\tan\theta$ are in G.P. then $\cos^9\theta+\cos^6\theta+3\cos^5\theta-1$ is equal to

(1) – 1 (2) 0

(3) 1 (4) none of these

41. If $\sin\alpha,\sin\beta,\sin\gamma$ are in A.P. and $\cos\alpha,\cos\beta,\cos\gamma$ are in G.P. then $\frac{\cos^2\alpha+\cos^2\gamma-4\cos\alpha\cos\gamma}{1-\sin\alpha\sin\gamma}=$

(1) – 2 (2) – 1

(3) 0 (4) 2

42. If $\cos\alpha+\cos\beta=a,\sin\alpha+\sin\beta=b$ and $\alpha-\beta=2\theta$, then $\frac{\cos3\theta}{\cos\theta}=$

(1) a^2+b^2-2 (2) a^2+b^2-3

(3) $3-a^2-b^2$ (4) $(a^2+b^2)/4$

43. If $\cos A=3/4$, then the value of $16\cos^2(A/2)-32\sin(A/2)\sin(5A/2)$ is

(1) – 4 (2) – 3

(3) 3 (4) 4

44. If $D=\begin{vmatrix}1&\cos\theta&1\\-\sin\theta&1&-\cos\theta\\-1&\sin\theta&1\end{vmatrix}$ then *D* lies in the interval

(1) $[0,4]$ (2) $[2,4]$

(3) $[2-\sqrt{2},2+\sqrt{2}]$ (4) $[-2,2]$

45. The value of θ lying between $\theta=0$ and $\theta=\pi/2$ and satisfying the equation $\begin{vmatrix}1+\sin^2\theta&\cos^2\theta&4\sin4\theta\\\sin^2\theta&1+\cos^2\theta&4\sin4\theta\\\sin^2\theta&\cos^2\theta&1+4\sin4\theta\end{vmatrix}=0$ is

(1) $3\pi/24$ (2) $5\pi/24$

(3) $11\pi/24$ (4) $\pi/24$

46. If $x=\frac{\sin^3P}{\cos^2P},y=\frac{\cos^3P}{\sin^2P};$ and $\sin P+\cos P=\frac{1}{2}$, then $x+y=$

(1) 75/18 (2) 44/9

(3) 79/18 (4) 48/9

47. If $\sin\theta+\cos ec\theta=2$, then $\sin^n\theta+\cos ec^n\theta=$

(1) 2^n (2) 2^{-n}

(3) 2 (4) $2n$

48. If $a\cos A-b\sin A=c$, then $a\sin A+b\cos A$ is equal to

(1) $\pm\sqrt{a^2+b^2-c^2}$ (2) $\pm\sqrt{b^2+c^2-a^2}$

(3) $\pm\sqrt{c^2+a^2-b^2}$ (4) $\pm\sqrt{a^2+b^2+c^2}$

49. The general solution of the trigonometrical equation $\sin x+\cos x=1$ is

(1) $x=2n\pi,n\in\mathbf{I}$

(2) $x=2n\pi+\pi/2,n\in\mathbf{I}$

(3) $x=n\pi+(-1)^n\pi/4,-\pi/4,n\in\mathbf{I}$

(4) none of these

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

(1) $\pi/8$ (2) $\pi/4$

(3) $3\pi/8$ (4) $5\pi/8$

51. Number of solutions of the equations $\tan x+\sec x=2\cos x$ lying in the interval $[0,2\pi]$ is

(1) 0 (2) 1
(3) 2 (4) 3

52. The number of all possible triplets (a_1,a_2,a_3) such that $a_1+a_2\cos 2x+a_3\sin^2 x=0$ for all x is

(1) 0 (2) 1
(3) 3 (4) infinite

53. If $\tan(\cot x)=\cot(\tan x)$, then the value of $\sin 2x$ is

(1) $\pi/4$

(2) $4/(2n+1)\pi, n\in \mathbf{I}-\{-1,0\}$

(3) $2/\pi$

(4) $4\pi/(2n+1)(n\in \mathbf{I}, n>7)$

54. $\sin x+2\sin 2x=3+\sin 3x,\ 0\le x\le 2\pi$ has

(1) 2solutions in I quadrant
(2) one solution in II quadrant
(3) no solution in any quadrant
(4) one solution in each quadrant

55. Let $f(x)=(\sin^2\theta)x^2+(\cos^2\theta)x+\cos^2\theta, f(x)=0$ has no real roots, then $\cos^2\theta$ can be

(1) 3/4 (2) 1/4
(3) 1/8 (4) 1/16

56. The equation $(\cos P-1)x^2+(\cos P)x+\sin P=0$ where x is a variable, has real roots if P lies in the interval

(1) $(0,2\pi)$ (2) $(-\pi,0)$

(3) $(-\pi/2,\pi/2)$ (4) $(0,\pi)$

57. The set of values of x for which $\dfrac{\tan 3x-\tan 2x}{1+\tan 3x\tan 2x}=1$ is

(1) ϕ (2) $\{\pi/4\}$

(3) $\{n\pi+\pi/4, n=1,2,3...\}$

(4) $\{2n\pi+\pi/4, n=1,2,3...\}$

58. The general solution of the equation

$$\frac{1-\sin x+...+(-1)^n\sin^n x+...}{1+\sin x+...+\sin^n x+...}=\frac{1-\cos 2x}{1+\cos 2x}$$

$x\ne(2x+1)\pi/2,\ n\in \mathbf{I}$ is

(1) $(-1)^n(\pi/3)+n\pi$

(2) $(-1)^n(\pi/6)+n\pi$

(3) $(-1)^{n+1}(\pi/6)+n\pi$

(4) $(-1)^{n-1}(\pi/3)+n\pi, (n\in \mathbf{I})$

59. The number of solutions of the equation

$$\sin^5 x-\cos^5 x=\frac{1}{\cos x}-\frac{1}{\sin x}(\sin x\ne\cos x)$$

is

(1) 0 (2) 1
(3) infinite (4) none of these

60. General solution of the equation $\log_2\sin x-\log_2\cos x-\log_2(1-\tan x)-\log_2(1+\tan x)+1=0$ is

(1) $(2n+1)\pi/8$ (2) $(16n+1)\pi/8$

(3) $(2n+1)\pi/4$ (4) none of these

61. The smallest positive root of the equation $\tan x-x=0$ lies in

(1) I quadrant (2) II quadrant
(3) III quadrant (4) IV quadrant

62. If $\sin^4 x+\cos^4 y+2=4\sin x\cos y,\ 0\le x,y\le\pi/2$ then $\sin x+\cos y=$

(1) – 2 (2) 0
(3) 2 (4) none of these

63. $\tan(p\pi/4)=\cot(q\pi/4)$ if

(1) $p+q=0$ (2) $p+q=2n+1$
(3) $p+q=2n$ (4) $p+q=2(2n+1)$

64. If $\sin x = \cos y, \sqrt{6}\sin y = \tan z$ and $2\sin z = \sqrt{3}\cos x; u, v, w$ denote respectively $\sin^2 x, \sin^2 y, \sin^2 z$ then the value of the triplet (u, v, w) is

(1) $(1,0,0)$ (2) $(0,1,0)$

(3) $(1/2, 1/2, 3/4)$ (4) $(1/2, 3/4, 1/2)$

65. A solution (x, y) of the system of equation $x - y = 1/3$ and $\cos^2(\pi x) - \sin^2(\pi y) = 1/2$ is given by

(1) $(2/3, 1/3)$ (2) $(7/6, 1/6)$

(3) $(13/6, 11/6)$ (4) $(1/6, 5/6)$

66. If $x + y + z = \pi, \tan x \tan y = 2,$ $\tan x + \tan y + \tan z = 6,$ then the value of z is

(1) $n\pi + \pi/4, n \in \mathbf{I}$ (2) $n\pi + \tan^{-1} 2, n \in \mathbf{I}$

(3) $n\pi + \tan^{-1} 3, n \in \mathbf{I}$ (4) none of these

67. $\cos 2x - 3\cos x + 1 = \dfrac{1}{(\cot 2x - \cot x)\sin(x - \pi)}$ holds.

(1) if cos $x = 0$

(2) if $\cos x = 1$

(3) if $\cos x = 2/5$

(4) for no real value of x

68. $\cos(x - y) - 2\sin x + 2\sin y = 3$ if

(1) $\sin x = \sin y$

(2) $x + y = 2n\pi, x - y = (2k - 1)\pi/2$

(3) $x = 2k\pi - \pi/2, y = 2n\pi + \pi/2$

(4) $\cos(x - y) = -1 (n, k \in \mathbf{I})$

69. The equation $8\cos x \cos 2x \cos 4x = \dfrac{\sin 6x}{\sin x}$ has a solution given by

(1) $x = n\pi$

(2) $x = n\pi + \pi/4$

(3) $x = (2n + 1)\pi/14$

(4) $x = (2n + 1)\pi/7 (n \in \mathbf{I})$

70. $\dfrac{\cos 3\theta}{2\cos 2\theta - 1} = \dfrac{1}{2}$ if

(1) $\theta = n\pi + \dfrac{\pi}{3}$ (2) $\theta = 2n\pi + \dfrac{\pi}{3}$

(3) $\theta = 2n\pi + \dfrac{\pi}{6} (n \in \mathbf{I}) (n \in \mathbf{I})$

(4) $\theta = n\pi + \dfrac{\pi}{6}$

71. If $6\cos 2\theta + 2\cos^2(\theta/2) + 2\sin^2\theta = 0,$ $-\pi < \theta < \pi,$ then θ is equal to

(1) $\pi/3$

(2) $\pi/3, \cos^{-1}(3/5)$

(3) $\cos^{-1}(3/5)$

(4) $\pi/3, \pi - \cos^{-1}(3/5)$

72. The number of integral values of a for which the equation $\cos 2x + a\sin x = 2a - 7$ possesses solution is

(1) 2 (2) 3

(3) 4 (4) 5

73. The least difference between the roots of the equation

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

$(0 \le x \le \pi/2)$ is

(1) $\pi/6$ (2) $\pi/4$

(3) $\pi/3$ (4) $\pi/2$

74. The equation

$\cos^4 x - (a + 2)\cos^2 x - (a + 3) = 0$

possesses a solution if

(1) $a > -3$ (2) $a < -2$

(3) $-3 \le a \le -2$

(4) a is any positive integer

75. The solution of $|\cos x| = \cos x - 2\sin x$ is

(1) $x = n\pi$ (2) $x = n\pi + \pi/4$

(3) $x = n\pi + (-1)^n (\pi/4) (n \in \mathbf{I})$

(4) $x = (2n + 1)\pi + \pi/4$

EXERCISES

1. If $2\tan\alpha+\cot\beta=\tan\beta$, then the value of $\tan(\beta-\alpha)$ is
   (1) $\tan\alpha$ (2) $\cot\alpha$
   (3) $\tan\beta$ (4) $\cot\beta$

2. If $\cos(x-y)=a\cos(x+y)$, then cot *x* cot *y* is equal to
   (1) $\frac{a-1}{a+1}$ (2) $\frac{a+1}{a-1}$
   (3) $a-1$ (4) $a+1$

3. $\sin^2 A+\sin^2(A-B)+2\sin A\cos B\sin(B-A)$ is equal to
   (1) $\sin^2 A$ (2) $\sin^2 B$
   (3) $\cos^2 A$ (4) $\cos^2 B$

4. If $\frac{3\sin 2\theta}{5+4\cos 2\theta}=1$, then the value of tan θ is equal to
   (1) 1 (2) 1/3
   (3) 3 (4) none of these

5. If $x=a\sec^3\theta\tan\theta, y=b\tan^3\theta\sec\theta$, then $\sin^2\theta$ is equal to
   (1) $\frac{x}{a}-\frac{y}{b}$ (2) $\frac{x}{a}+\frac{y}{b}$
   (3) $\frac{xy}{ab}$ (4) $\frac{ay}{bx}$

6. $\cot\theta-\cot 3\theta$ is equal to
   (1) $2\sin\theta\sin 3\theta$ (2) $2\cos\theta\cos 3\theta$
   (3) $2\cos\theta\cos ec3\theta$ (4) $2\sin\theta\cos ec3\theta$

7. If $0<x,y<2\pi$, the number of solutions of the system of equations $\sin x\sin y=3/4$ and $\cos x\cos y=1/4$ is
   (1) 0 (2) 1
   (3) 2 (4) infinite

8. If A and B be acute positive angles satisfying $3\sin^2 A+2\sin^2 B=1, 3\sin 2A-2\sin 2B=0$ then
   (1) $B=\pi/4-A/2$ (2) $A=\pi/4-2B$
   (3) $B=\pi/2-A/4$ (4) $A=\pi/4-B/2$

9. If $\tan\alpha,\tan\beta,\tan\gamma$ are the roots of the equation $x^3-px^2-r=0$, then the value of $(1+\tan^2\beta)(1+\tan^2\gamma)$ is equal to
   (1) $(p-r)^2$ (2) $1+(p-r)^2$
   (3) $1-(p-r)^2$ (4) none of these

10. If A, B, C are the angles of triangle such that angle A is obtuse then
    (1) $\tan A\tan B<1$
    (2) $\tan B\tan C<1$
    (3) $\tan C\tan A<1$
    (4) $\tan A\tan B\tan C<1$

11. If $\tan(\theta/2)=\cos ec\theta-\sin\theta$, then $\cos^2(\theta/2)$ is equal to
    (1) $\sin 18°$ (2) $\cos 36°$
    (3) $\sin 36°$ (4) $\cos 18°$

12. If
    $a\sin^2\theta+b\cos^2\theta=a\cos^2\phi+b\sin^2\phi=1$
    and $a\tan\theta=b\tan\phi\,(a\neq b)$ then
    (1) $a+b=2ab$ (2) $a-b=2ab$
    (3) $a-b+2ab=0$ (4) $a+b+2ab=0$

13. The acute angle of a rhombus whose side is a mean proportional
    (1) 15° (2) 20°
    (3) 30° (4) 80°

14. Given the height *h* and the angle bisector/drawn from the vertex of the right angle of a triangle , then cosine of an acute angle of the triangle is given by
    (1) $\frac{h+\sqrt{l^2-h^2}}{\sqrt{2}h}$ (2) $\frac{h-\sqrt{l^2-h^2}}{\sqrt{2}h}$

(3) $\frac{h}{l}$ (4) $\frac{h-\sqrt{l^2-h^2}}{\sqrt{2}\,l}$

15. If $2\sin^2\left(x+\frac{\pi}{4}\right)+\sqrt{3}\cos 2x>0$, then

(1) $\cos\left(2x-\frac{\pi}{6}\right)>-\frac{1}{2}$

(2) $\sin\left(2x-\frac{\pi}{6}\right)<-\frac{1}{2}$

(3) $\sin\left(2x-\frac{\pi}{6}\right)>-\frac{1}{2}$

(4) $\cos\left(2x-\frac{\pi}{6}\right)<-\frac{1}{2}$

16. The equation $\sin^4 x+\cos^4 x=a$ has a real solution if

(1) $0<a\le 1$ (2) $1/2\le a\le 1$

(3) $1/4\le a\le 1/2$ (4) $-1\le a\le 1$

17. $x=\sum_{n=0}^{\infty}\cos^{2n}\theta, y=\sum_{n=0}^{\infty}\sin^{2n}\theta, z=\sum_{n=0}^{\infty}\cos^{2n}\theta,$ $\sin^{2n}\theta, |\cos\theta|<1, |\sin\theta|<1$ then $x+y+z$ is equal to

(1) xy (2) yz

(3) zx (4) xyz

18. For $n\in \mathbf{I}$, the line $x=n\pi+\pi/2$ does not intersect the graph of

(1) $\cot(x+\pi)$ (2) $\cot(x-\pi)$

(3) $\sin x$ (4) $\tan x$

19. The least positive value of x satisfying

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

(1) $\pi/3$ (2) $\pi/6$

(3) $2\pi/3$ (4) $5\pi/6$

20. In a triangle ABC right angled at C, $\frac{\sin^2 A}{\sin^2 B}-\frac{\cos^2 A}{\cos^2 B}$ is equal to

(1) $\frac{(a^2-b^2)c^2}{a^2b^2}$ (2) $\frac{a^4+b^4}{a^2b^2}$

(3) $\frac{(b^2-c^2)a^2}{b^2c^2}$ (4) $\frac{(c^2-a^2)b^2}{c^2a^2}$

21. If

$\frac{\tan x}{2}=\frac{\tan y}{3}=\frac{\tan z}{5}$ and $x+y+z=\pi$, then the value of $\tan^2 x+\tan^2 y+\tan^2 z$ is

(1) 38/3 (2) 38

(3) 114 (4) none of these

22. If the angles A, B, C of a triangle are in A.P. such that $\sin(2A+B)=1/2$ then $\sin(B+2C)=$

(1) $-1/2$ (2) 1/2

(3) $\sqrt{3}/2$ (4) $1/\sqrt{2}$

23. $\cos 7.5°=$

(1) $\sqrt{\frac{2+\sqrt{2}+\sqrt{6}}{8}}$ (2) $\sqrt{\frac{4+\sqrt{2}+\sqrt{6}}{8}}$

(3) $\frac{2\sqrt{2}+\sqrt{3}+1}{2\sqrt{2}}$ (4) $\sqrt{\frac{4+\sqrt{2}+\sqrt{6}}{4}}$

24. If

$\tan\theta+\tan\phi=a, \cot\theta+\cot\phi=b, \theta-\phi=\alpha$ $(\neq 0)$ then

(1) $ab<4$ (2) $ab=4$

(3) $ab>4$ (4) $ab=0$

25. If $\frac{x}{y}=\frac{\cos A}{\cos B}$ then $\frac{x\tan A+y\tan B}{x+y}=$

(1) $\frac{\sin A+\cos B}{\cos A+\sin B}$ (2) $\frac{\sin A+\sin B}{\cos A\cos B}$

(3) $\tan\frac{A+B}{2}$ (4) $\cot\frac{A-B}{2}$

26. If

$x=a(\cos\theta+\theta\sin\theta), y=a(\sin\theta-\theta\cos\theta)$

then $a\theta =$

(1) $x+y-a$ (2) $\sqrt{x^2+y^2-a^2}$

(3) $\sqrt{x^2-y^2+a^2}$ (4) $x-y+a$

27. $\left(1+\cos\left(\pi/8\right)\right)\left(1+\cos\left(3\pi/8\right)\right)(1+\cos(7\pi/8))=$

(1) 1/2 (2) $\cos\left(\pi/8\right)$

(3) 1/8 (4) $\left(1+\sqrt{2}\right)/2\sqrt{2}$

28. If $2\cos x+2\cos 3x=\cos y$, $2\sin x+2\sin 3x=\sin y$ then the value of $\cos 2x$ is

(1) $-7/8$ (2) 1/8

(3) – 1/8 (4) 7/8

29. $\frac{\cos A}{3}=\frac{\cos B}{4}=\frac{1}{5},-\frac{\pi}{2}<A<0,0<B<\frac{\pi}{2}$, then $3\sin A+4\sin B=$

(1) 0 (2) – 1

(3) 24/5 (4) 1

30. The value of $\log_3\tan 1^\circ+\log_3\tan 2^\circ+\ldots+\log_3\tan 89^\circ$ is

(1) 3 (2) 1

(3) 2 (4) 0

31. If $x=X\cos\theta-Y\sin\theta$, $y=X\sin\theta+Y\cos\theta$; and $ax^2+2bxy+cy^2=AX^2+2HXY+BY^2$, then

(1) $H=0$ *If* $\theta=0$

(2) $H=B$ *If* $\theta=\pi/2$

(3) $A+B=a+c$

(4) $H=c-a$ *If* $\theta=\pi/4$

32. If $\frac{\tan^3\left((\pi/2)-\theta\right)}{\sec^2\theta}\cdot\frac{\cot^2\theta}{\sec\left((\pi/2)-\theta\right)}\cdot\frac{\sin\left((\pi/2)-\theta\right)}{\sin^4\theta}=\cot^n\theta$ then $n=$

(1) 2 (2) 4

(3) 6 (4) 8

33. If $\sin 5\theta=a\sin^5\theta+b\sin^3\theta+c\sin\theta+d$, then

(1) $a+b+c=0$ (2) $a+b+c+d=0$

(3) $5a+3b-4c=0$ (4) $a-3c+d=0$

34. The number of solutions of $\sin\theta+2\sin 2\theta+3\sin 3\theta+4\sin 4\theta=10$, $0<\theta<\pi$ is

(1) 0 (2) 1

(3) 2 (4) 4

35. If $\tan A-\tan B=x$ and $\cot B-\cot A=y$, then the value of $\cot\left(A-B\right)$ is

(1) $\frac{x-y}{xy}$ (2) $\frac{1}{x^2}+\frac{1}{y^2}$

(3) $\frac{x+y}{xy}$ (4) xy

36. $\frac{\cos 3\theta}{\cos^3\theta}+\frac{\sin 3\theta}{\sin^3\theta}$ is equal to

(1) $3\cos 2\theta\cos ec2\theta$ (2) $3\cot 2\theta\cos ec2\theta$

(3) $12\cot 2\theta\cos ec2\theta$ (4) $12\tan 2\theta\sec 2\theta$

37. $\left(x\tan\alpha+y\cot\alpha\right)\left(x\cot\alpha+y\tan\alpha\right)-4xy\cos^2 2\alpha=$

(1) x^2+y^2 (2) $4xy$

(3) $\left(x+y\right)^2$ (4) none of these

38. cos 11° – cos 2° is

(1) a positive integer

(2) a negative integer

(3) a positive rational number

(4) a negative rational number

39. If sin A, cos A and tan A are in G.P.,then $\cot^6 A-\cot^2 A=$

(1) – 1 (2) 0
(3) 1 (4) none of these

40. If tan A tan B, tan C satisfy the equation $3\tan^3\theta - 4\tan^2\theta + 3\tan\theta + 1 = 0$, then A + B + C =
(1) 0 (2) $\pi/2$
(3) $3\pi/4$ (4) 2π

41. If $x\sin\theta + y\sin 2\theta + z\sin 3\theta = \sin 4\theta$, $(\theta \neq n\pi)$ then $8\cos^3\theta - 4z\cos^2\theta - 2(y+2)\cos\theta$ is equal to
(1) $x - y$ (2) $x - z$
(3) $y - z$ (4) none of these

42. The number of values of sin x satisfying $\sin 5x = 5\sin x$ is
(1) 0 (2) 1
(3) 2 (4) 3

43. If $\sin\alpha, \sin\beta$ are the roots of the equaton $a\sin^2\theta + b\sin\theta + c = 0$ and $\sin\alpha + 2\sin\beta = 1$ then $a^2 + 2b^2 + 3ab + ac =$
(1) – 1 (2) 0
(3) 1 (4) $a + b + c$

44. If $\sin(\theta/2) = a, \cos(\theta/2) = b$, then $(1+\sin\theta)(3\sin\theta + 4\cos\theta + 5) =$
(1) $(a+b)^2(a+3b)^2$ (2) $(a+b)^2(3a+b)^2$
(3) $(a-b)^2(a-3b)^2$ (4) $(a-b)^2(3a-b)^2$

45. If $\cos x - \sin x = 1/2$, then tan $2x$ =
(1) $\sqrt{7}/3$ (2) $\sqrt{7}/4$
(3) $3/\sqrt{7}$ (4) $2/\sqrt{7}$

46. which of the following gives the least value of A
(1) $\cos 2A = \sin 3A$ (2) $\cos 3A = \sin 7A$
(3) $\tan A = \cot 3A$ (4) $\cot A = \tan 2A$

47. If A, B, C are acute positive angles such that $A + B + C = \pi$ and $\cot A \cot B \cot C = k$, then
(1) $k \geq 3$ (2) $k \leq \frac{1}{3\sqrt{3}}$
(3) $k \leq 3$ (4) $k \geq \frac{1}{3\sqrt{3}}$

48. If $\sin A = \sin B$ and cosA =cosB; $A \neq B$, then
(1) $\tan\frac{A-B}{2} = 0$ (2) $\cos(A+B) = 1$
(3) $\tan\frac{A+B}{2} = 0$ (4) $\sin(A-B) = 1/2$

49. cos 22° + cos 78° +cos 80° =
(1) 4 sin 11° sin 39° sin 40°
(2) 1+4 cos 11° cos 39°cos 40°
(3) 1+4 sin 11° sin 39° sin 40°
(4) 4 cos 11° cos 39°cos 40°

50. $\tan x + \frac{1}{2}\tan\frac{x}{2} + \frac{1}{2^2}\tan\frac{x}{2^2} + \ldots + \frac{1}{2^{n-1}}\tan\frac{x}{2^{n-1}}$ is equal to
(1) $\frac{1}{2^n}\cot\frac{x}{2^n} - 2\cot 2x$
(2) $\frac{1}{2^{n-1}}\cot\left(\frac{x}{2^{n-1}}\right) - 2\cot 2x$
(3) $\tan\frac{2^n - 1}{2^{n-1}}x$
(4) $2\cot 2x - \frac{1}{2^{n-1}}\cot\frac{x}{2^{n-1}}$

51. If $4n\alpha = \pi$, then the value of tan 2α tan 3α .... $\tan(2n-1)\alpha$ is
(1) – 1 (2) 0
(3) 1 (4) none of these

52. The value of $\frac{3 + \cot 76^\circ \cot 16^\circ}{\cot 76^\circ + \cot 16^\circ}$ is
(1) cot 44° (2) cot 46°
(3) tan 2° (4) cot 92°

53. If $x\cos\theta = y\cos(\theta + 2\pi/3) =$

$z\cos(\theta+4\pi/3)$ then $xy+yz+zx=$

(1) $\cos^2\theta$ (2) $\sin^2\theta$

(3) 1 (4) 0

54. If $A>0, B>0$ and $A+B=\pi/3$ then the maximum value of tan A tan B is

(1) $1\sqrt{3}$ (2) 1/3

(3) $\sqrt{3}$ (4) 3

55. If $\tan\theta, 2\tan\theta+2, 3\tan\theta+3$ are in G.P.,then the value of $\frac{7-5\cot\theta}{9-4\sqrt{\sec^2\theta-1}}$ is

(1) 12/5 (2) – 33/28

(3) 33/100 (4) 12/13

56. If $\sin\theta+\cos\theta=a$ and $\cos\theta-\sin\theta=b$, then $\sin\theta(\sin\theta-\cos\theta)+\sin^2\theta(\sin^2\theta-\cos^2\theta)+\sin^3\theta(\sin^3\theta-\cos^3\theta)+$ ....is equal to

(1) $\frac{1-ab}{1+ab}$ (2) $\frac{1-a^2}{3-a^2}$

(3) $\frac{1-ab}{1+ab}+\frac{1-a^2}{3-a^2}$ (4) $\frac{1+ab}{1-ab}-\frac{a^2-1}{3-a^2}$

57. If $x>0$ and $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & x & 1 \\ \cos\theta & 1 & x \end{vmatrix}=0$ then

(1) $x<\sqrt{2}$ (2) $x=\sqrt{2}$

(3) $x>\sqrt{2}$ (4) none of these

58. If $x_1, x_2, x_3..., x_n$ are in A.P.whose common difference is θ, then the value of $\sin\theta(\sec x_1, \sec x_2, \sec x_3+...+\sec x_{n-1}\sec x_n)$ is

(1) $\frac{\sin n\theta}{\cos x_1\cos x_n}$ (2) $\frac{\sin(n-1)\theta}{\cos x_1\cos x_n}$

(3) $\sin n\theta\cos x_1\cos x_n$ (4) $\frac{\cos(n-1)\theta}{\sin x_1\sin x_n}$

59. If $x_{n+1}=\sqrt{\frac{1}{2}(1+x_n)}$, then

$\cos\left[\frac{\sqrt{1-x_0^2}}{x_1x_2x_3...to\ \inf\ init}\right](-1<x_0<1)$ is

equal to

(1) – 1 (2) 1

(3) x_0 (4) $1/x_0$

60. If $\left(1+\sqrt{1+x}\right)\tan\alpha=\left(1-\sqrt{1-x}\right)$ then $x=$

(1) $\sin\alpha$ (2) $\sin 2\alpha$

(3) $\sin 4\alpha$ (4) $\cos 4\alpha$

61. If $f(\theta)=\sin\theta(\sin\theta+\sin 3\theta)$, then $f(\theta)$

(1) ≥ 0 only when $\theta\geq 0$

(2) ≤ 0 for all real θ

(3) ≥ 0 for all real θ

(4) ≤ 0 only when $\theta\leq 0$

62. In a right angled triangle, the hypotenuse is $2\sqrt{2}$ times the length of the perpendicular drawn from the opposite vertex on its hypotenuse then the other two angles are

(1) $\pi/3, \pi/6$ (2) $\pi/4, \pi/4$

(3) $\pi/8, 3\pi/8$ (4) $\pi/12, 5\pi/12$

63. $\sqrt{\cos 2x}+\sqrt{1+\sin 2x}=2\sqrt{\sin x+\cos x}$ if

(1) sin x +cos x =1 (2) $x=2n\pi$

(3) $x=n\pi+\pi/4$ (4) sin x – cos x = 0

64. If $\cot(\pi/3)\cos(2\pi x)=\sqrt{3}$, the general solution of the equation is

(1) $2n\pi\pm\pi/3$ (2) $n\pm 1/3$

(3) $n\pm 1/6$ (4) $n\pm 1/2 (n\in \mathbf{I})$

65. $2\cos^2 x+4\cos x=3\sin^2 x$ if

(1) $\cos x=\frac{-2+\sqrt{14}}{5}$ (2) $\cos x=\frac{-2+\sqrt{19}}{5}$

(3) $\sin x=\frac{-2+\sqrt{14}}{5}$ (4) $\sin x=\frac{-2+\sqrt{19}}{5}$

66. $\sin x+2\sin 2x=3+\sin 3x$

(1) if $\sin x+\cos 2x=0$

(2) if $\sin 2x-1=0$

(3) if $\cos x=0$

(4) for no real value of x

67. $6\tan^2 x-2\cos^2 x=\cos 2x$ if

(1) $\cos 2x=-1$ (2) $\cos 2x=1$

(3) $\cos 3x=-1/2$ (4) $\cos 3x=1/2$

68. The greatest value of $\cos\theta$ for which $\cos 5\theta=0$ is

(1) 0 (2) $\left(1+\sqrt{5}\right)/4$

(3) $\sqrt{\frac{5+\sqrt{5}}{8}}$ (4) $\sqrt{\frac{\sqrt{5}+1}{4}}$

69. If $\tan p\theta=\tan q\theta$, then the values of θ form an A.P. with common difference

(1) $\pi(p+q)$ (2) π/p

(3) π/q (4) $\pi(p-q)$

70. The number of pairsn (x,y) satisfying the equation $\sin x+\sin y=\sin(x+y)$ and $|x|+|y|=1$ is

(1) 2 (2) 4

(3) 6 (4) infinite

71. The equation $\int_0^x\left(t^2-8t+13\right)dt=x\sin(a/x)$ has a solution if $\sin(a/6)=$

(1) 0 (2) 1

(3) 3 (4) 6

72. The smallest positive root of the equation $\sqrt{\sin(1-x)}=\sqrt{\cos x}$ is

(1) $1/2+\pi/4$ (2) $1/2+3\pi/4$

(3) $1/2+5\pi/4$ (4) $1/2+7\pi/4$

73. The sum of the roots of the equation $4\cos^3 x-4\cos^3 x-\cos(\pi+x)-1=0$ in the interval $[0,315]is\ p\pi$, where p is equal to

(1) 2500 (2) 2550

(3) 2600 (4) 2651

74. A solution (x,y) of $x^2+2x\sin xy+1=0$ is

(1) $(1,0)$ (2) $(1,7\pi/2)$

(3) $(-1,7\pi/2)$ (4) $(-1,0)$

75. $e^{\sin x}-e^{-\sin x}=4$ for

(1) all real values of x

(2) some $x\in[0,\pi/2]$

(3) some $x\in(-\pi/2,\pi/2)$

(4) no real value of x

TOPICS COVERED

INVERSE TRIGONOMETRIC FUNCTIONS

1. If $x = 1/5$, the value of $\cos\left(\cos^{-1}x + 2\sin^{-1}x\right)$

(1) $-\sqrt{24/25}$ (2) $\sqrt{24/25}$

(3) – 1/5 (4) 1/5

2. If $0 \le x \le 1$ and $\theta = \sin^{-1}\cos x + \cos^{-1}x - \tan^{-1}x$, then

(1) $\theta \le \pi/2$ (2) $\theta \ge \pi/4$

(3) $\theta = \pi/4$ (4) $\pi/4 \le \theta\, \pi/2$

3. If $x > 0, y > 0$ and $x > y$, then $\tan^{-1}(x/y) + \tan^{-1}\left[(x+y)/(x-y)\right]$ is equal to

(1) $-\pi/4$ (2) $\pi/4$

(3) $3\pi/4$ (4) none of these

4. The principal value of $\sin^{-1}\left(-\sqrt{3}/2\right) + \cos^{-1}\left(7\pi/6\right)$ is

(1) $5\pi/6$ (2) $\pi/2$

(3) $3\pi/2$ (4) none of these

5. The value of $\cos^{-1}\left(-1/2\right) - 2\sin^{-1}\left(1/2\right) + 3\cos^{-1}\left(-1/\sqrt{2}\right) - 4\tan^{-1}\left(-1\right)$ is equal to

(1) $7\pi/4$ (2) $11\pi/4$

(3) $\pi/12$ (4) $25\pi/12$

6. If $\operatorname{cosec}^{-1}x = 2\cot^{-1} + \cos^{-1}\left(3/4\right)$ then the value of x is

(1) 44/117 (2) 135/117

(3) 24/7 (4) 5/3

7. $\theta = \tan^{-1}\left(2\tan^{1}\theta\right) - \tan^{-1}\left((1/3)\tan\theta\right)$ if $\tan\theta$ is equal to

(1) – 2 (2) – 1

(3) 2/3 (4) 2

8. If $\tan^{-1}\dfrac{\sqrt{1+x^2}-1}{x} = 4$ then x =

(1) tan 2 (2) tan 4

(3) tan (1/4) (4) tan 8

9. $\sec^2\left(\tan^{-1}2\right) + \operatorname{cosec}^2\left(\cot^{-1}3\right)$ is equal to

(1) 1 (2) 5

(3) 10 (4) 15

10. The equation $2\cos^{-1}x = \cos^{-1}x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ is valid for all values of x satisfying

(1) $-1 \le x \le 1$ (2) $0 \le x \le 1$

(3) $0 \le x \le 1/\sqrt{2}$ (4) $1/\sqrt{2} \le x \le 1$

11. If $A = \tan^{-1}\left(1/7\right), B = \tan^{-1}\left(1/3\right)$, then

(1) cos 2A = sin 2A (2) cos 2A = sin 2B

(3) cos 2A = sin 2B (4) cos 2A = sin 4B

12. If $u = \cos^{-1}\sqrt{\tan\alpha} - \tan^{-1}\sqrt{\tan\alpha}$, then $\tan\left(\dfrac{\pi}{4} - \dfrac{u}{2}\right) =$

(1) $\sqrt{\tan\alpha}$ (2) $\sqrt{\cot\alpha}$

(3) $\tan\alpha$ (4) $\cot\alpha$

13. If $\tan^{-1}y = 4\tan^{-1}x$, then $1/y$ is zero for

(1) $x = 1 \pm \sqrt{2}$ (2) $x = \sqrt{2} \pm \sqrt{3}$

(3) $3 \pm 2\sqrt{2}$ (4) all values of x

14. $3\cos^{-1}x - \pi x - \pi/2 = 0$ has

(1) one solution
(2) one and only one solution
(3) no solution
(4) more than one solution

15. If $\cos^{-1}x = \tan^{-1}x$, then $\sin\left(\cos^{-1}x\right) =$

(1) x (2) x^2
(3) $1/x$ (4) $1/x^2$

16. An integral solution of the equation $\tan^{-1}x + \tan^{-1}(1/y) = \tan^{-1}3$ is

(1) (1, 4) (2) (4, 13)
(3) (2, 1) (4) none of these

17. If $\sin^{-1}(\tan\pi/4) - \sin^{-1}\sqrt{3/x} - \pi/6 = 0$, then x is root of the eqaution

(1) $x^2 - x - 6 = 0$ (2) $x^2 + x - 6 = 0$
(3) $x^2 - x - 12 = 0$ (4) $x^2 + -12 = 0$

18. If $\tan^{-1}\frac{1}{1+2} + \tan^{-1}\frac{1}{1+(2)(3)} +$

$\tan^{-1}\frac{1}{1+(3)(4)} + ... + \tan^{-1}\frac{1}{1+n(n+1)} = \tan^{-1}\theta$,

then θ =

(1) $\frac{n}{n+1}$ (2) $\frac{n+1}{n+2}$
(3) $\frac{n}{n+2}$ (4) $\frac{n-1}{n+2}$

19. If $\sin^{-1}x + \cos^{-1}(1-x) = \sin^{-1}(-x)$, then x satisfies the equation

(1) $2x^2 - x + 2 = 0$ (2) $2x^2 - 3x = 0$
(3) $2x^2 + x - 1 = 0$ (4) none of these

20. $x = n\pi - \tan^{-1}3$ is a solution of the equation

$12\tan 2x + \frac{\sqrt{10}}{\cos x} + 1 = 0$

(1) n is any integer
(2) n is an even integer
(3) n is a positive integer
(4) n is an odd integer

21. The arithmetic mean of the non-zero solution of the equation

$\tan^{-1}\frac{1}{2x+1} + \tan^{-1}\frac{1}{4x+1} = \tan^{-1}\frac{2}{x^2}$ is

(1) 2/3 (2) 7/3
(3) 7/6 (4) 11/6

22. If $\frac{1}{2}\sin^{-1}\left[\frac{3\sin 2\theta}{5+4\cos 2\theta}\right] = \tan^{-1}x$, then x =

(1) $\tan 3\theta$ (2) $3\tan\theta$
(3) $(1/3)\tan\theta$ (4) $3\cot\theta$

23. If $y = \sec^{-1}\left[\frac{x+1}{x-1}\right] + \sin^{-1}\left[\frac{x-1}{x+1}\right]$ and $z = \cos ec^{-1}\left[\frac{2x+3}{3x+2}\right] + \cos^{-1}\left[\frac{3x+2}{2x+3}\right]$ then $y + z$ =

(1) 0 (2) π
(3) $(x-1)/(x+1)$ (4) $(3x+2)/(2x+3)$

24. If $a = \sin\left(\cot^{-1}x\right)$ and $b = \cot\left(\sin^{-1}x\right)$ where $x > 0$, then $1/x^2 - x^2 =$

(1) b^2/a^2 (2) a^2/b^2
(3) $\left(a^1+1\right)/\left(b^1-1\right)$ (4) none of these

25. If $x > 0$ and

$\sin^{-1}(5/x) + \sin^{-1}(12/x) = \pi/2$. then x =

(1) 7 (2) 13
(3) 17 (4) 34

26. If $\left(\tan^{-1}x\right)^2 + \left(\cot^{-1}x\right)^2 = 5\pi^2/8$, then x =

(1) – 1 (2) 0
(3) 1 (4) none of these

27. If x_1, x_2, x_3, x_4 are the roots of equation $x^4 - x^3\sin\beta + x^2\cos 2\beta - x\cos\beta - \sin\beta = 0$, then $\tan^{-1}x_2 + \tan^{-1}x_3 + \tan^{-1}x_4$ is equal to

(1) β (2) $\pi/2-\beta$

(3) $\pi-\beta$ (4) $-\beta$

28. If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=3\pi/2$, then the value of $x^{100}+y^{100}+z^{100}-\frac{9}{x^{101}+y^{101}+z^{101}}$ is

(1) – 1 (2) 0

(3) 1 (4) 3

29. The number of real solution of $\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\sqrt{x^2+x+1}=\pi/2$ is

(1) 0 (2) 1

(3) 2 (4) infinite

30. $\sum_{m=1}^{n}\tan^{-1}\frac{2m}{m^4+m^2+2}=$

(1) $\tan^{-1}\left(n^2+n+1\right)$ (2) $\tan^{-1}\left(n^2-n+1\right)$

(3) $\tan^{-1}\frac{n^2+n}{n^2+n+2}$ (4) none of these

EXERCISES

1. If $x = 2/3,$ then $\sin^2\left(\tan^{-1} x\right) + \cos^2\left(\sin^{-1} x\right)$ is equal to

(1) $\frac{99}{101}$ (2) $\frac{107}{117}$

(3) $\frac{101}{117}$ (4) none of these

2. A root of the equation

$17x^2 + 17x\tan\left[2\tan^{-1}(1/5) - \pi/4\right] - 10 = 0$ is

(1) $\frac{10}{17}$ (2) -1

(3) $-\frac{7}{17}$ (4) 1

3. $\cos^{-1}\sqrt{\frac{a-x}{a-b}} = \sin^{-1}\sqrt{\frac{x-b}{a-b}}$ is possible if

(1) $a > x > b$

(2) $a < b$ and x takes any value

(3) $a > b$ and x takes any value

(4) $a = x = b$

4. The value of $\cos^{-1}(\cos(-17\pi/5),$ is equal to

(1) $-17\pi/5$ (2) $3\pi/5$

(3) $2\pi/5$ (4) none of these

5. $\tan^{-1}(1/11) + \tan^{-1}(2/12)$ is equal to

(1) $\tan^{-1}(33/132)$ (2) $\tan^{-1}(1/2)$

(3) $\tan^{-1}(132/33)$ (4) none of these

6. The value of $(1/2)\cos^{-1}(3/5)$ is

(1) $\sin^{-1}(1/2)$ (2) $\cos^{-1}(1/2)$

(3) $\cot^{-1}(1/2)$ (4) $\tan^{-1}(1/2)$

7. The value of $\sin\left(\cot^{-1}\left(\cos\left(\tan^{-1} x\right)\right)\right)$

(1) $\sqrt{\frac{x^2+2}{x^2+1}}$ (2) $\sqrt{\frac{x^2+1}{x^2+2}}$

(3) $\frac{x}{\sqrt{x^2+2}}$ (4) $\sqrt{ab}$

8. If $\tan^{-1}(a/x) + \tan^{-1}(b/x) = \pi/2,$ then x is equa to

(1) ab (2) a/b

(3) b/a (4) $\sqrt{ab}$

9. IF $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi,$ where $-1 x, y \le 1$ and $x + y \ge 0,$ then $x^2 + y^2 + z^2 + 2xyz$ is equal to

(1) 0 (2) 1

(3) $(x+y+z)^2$ (4) $xy + yz + zx$

10. If $\cos^{-1}(x/2) + \cos^{-1}(y/3) = \theta,$ then $9x^2 - 12xy\cos\theta + 4y^2$ is equal to

(1) 0 (2) 36

(3) $36\sin^2\theta$ (4) $36\cos^2\theta$

11. If $\cos^{-1}(x/a) + \cos^{-1}(y/b) = \alpha.$ then $x^2/a^2 + y^2/b^2$ is equal to

(1) $(2xy/ab)\cos\alpha + \sin^2\alpha$

(2) $(2xy/ab)\sin\alpha + \cos^2\alpha$

(3) $(2xy/ab)\cos^2\alpha + \sin\alpha$

(4) $(2xy/ab)\sin^2\alpha + \cos\alpha$

12. If $\alpha = 2\tan^{-1}\left(2\sqrt{2} - 1\right)$ and $\beta = 3\sin^{-1}(1/3) + \sin^{-1}(3/5)$ then

(1) $\alpha < \beta$ (2) $\alpha = \beta$

(3) $\alpha > \beta$ (4) none of these

13. $\tan^{-1}\sqrt{\frac{a(a+b+c)}{bc}} + \tan^{-1}\sqrt{\frac{b(a+b+c)}{ca}} +$

$\tan^{-1}\sqrt{\frac{c(a+b+c)}{ab}}$ is equal to

(1) $\pi/4$ (2) $\pi/2$

(3) π (4) 0

14. If $a_1, a_2, a_3, ..., a_n$ is an A.P.with common ratio d, then

$$\tan\left[\tan^{-1}\frac{d}{1+a_1a_2}+\tan^{-1}\frac{d}{1+a_2a_3}+....+\tan^{-1}\frac{d}{1+a_{n-1}a_n}\right]=$$

(1) $\frac{(n-1)d}{a_1+a_n}$ (2) $\frac{(n-1)d}{1+a_1a_n}$

(3) $\frac{nd}{1+a_1a_n}$ (4) $\frac{a_n-a_1}{a_n+a_1}$

15. Two angles of a triangle are $\sin^{-1}\left(1/\sqrt{5}\right)$ and $\sin^{-1}\left(1/\sqrt{10}\right)$ then the third angle is

(1) $\pi/4$ (2) $3\pi/4$

(3) $\pi/6$ (4) $\pi/3$

16. If $x+1/x=5/2$, then the principal value of $\sin^{-1}x$ is

(1) $\pi/6$ (2) $\pi/4$

(3) $\pi/3$ (4) $5\pi/6$

17. If $y=\tan^{-1}\frac{1-x}{1+x}, 0\le x\le 1,$ then

(1) $0\le y\le\pi$ (2) $0\le y\le\pi/4$

(3) $-\pi/4\le y\le\pi/4$ (4) $\pi/4\le y\le\pi/2$

18. If $a,b,$ are positive quantities and $a_1=\frac{a+b}{2}, b_1=\sqrt{a_1b}, a_2=\frac{a_1+b_1}{2},$ $b_2=\sqrt{a_2b_1}$ and so on, $\lim_{n\to\infty} b_n$ is equal to

(1) $\frac{\sqrt{b^2-a^2}}{\cos^{-1}(a/b)}$ (2) $\frac{\sqrt{a^2+b^2}}{\cos^{-1}(b/a)}$

(3) $\frac{\sqrt{b^2-a^2}}{\cos^{-1}(b/a)}$ (4) $\frac{\sqrt{a^2+b^2}}{\cos^{-1}(a/b)}$

19. The number of positive integral pairs *(a, b)* satisfying the equation $\tan^{-1}a+\tan^{-1}b=\tan^{-1}7$ is

(1) 0 (2) 2

(3) 4 (4) infinite

20. $\frac{\alpha^3}{2}\cos ec^2\left(\frac{1}{2}\tan^{-1}\frac{\alpha}{\beta}\right)+\frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\frac{\beta}{\alpha}\right)$ is equal to

(1) $(\alpha+\beta)(\alpha^2+\beta^2)$

(2) $(\alpha-\beta)(\alpha^2+\beta^2)$

(3) $(\alpha-\beta)(\alpha^2-\beta^2)$

(4) $(\alpha+\beta)(\alpha^2-\beta^2)$

21. The value of $\sin^{-1}\left\{\cot\left[\sin^{-1}\sqrt{\frac{2-\sqrt{3}}{4}}+\cos^{-1}\frac{\sqrt{12}}{4}+\sec^{-1}\sqrt{2}\right]\right\}$ is equal to

(1) 0 (2) $\pi/12$

(3) $\pi/6$ (4) $\pi/4$

22. The sum of the infinite series $\cot^{-1}2+\cot^{-1}8+\cot^{-1}18+\cot^{-1}32+...$ is equal to

(1) $\pi/4$ (2) $\pi/2$

(3) $3\pi/4$ (4) none of these

23. The inequality $\sin^{-1}(\sin 5)>x^2-4x$ holds if

(1) $x=2-\sqrt{9-2\pi}$ (2) $x=2+\sqrt{9-2\pi}$

(3) $x\in\left(2-\sqrt{9-2\pi}, 2+\sqrt{9-2\pi}\right)$

(4) $x>2+\sqrt{9-2\pi}$

24. $\sin^{-1} x > \cos^{-1} x$ holds for
(1) all values of x
(2) $x \in \left(0, 1/\sqrt{2}\right)$
(3) $x \in \left(2-\sqrt{9-2\pi}, 2+\sqrt{9-2\pi}\right)$
(4) none of these

25. The value of $\cos^{-1} x + \cos^{-1}\left(\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right); \frac{1}{2} \le x \le 1$ is equal to
(1) $\pi/6$ (2) $\pi/4$
(3) $\pi/3$ (4) 0

26. The equation $\sin^{-1} 6x + \sin^{-1} 6\sqrt{3}x = -\pi/2$ has
(1) only integral solutions
(2) two integral solutions
(3) no integral solution
(4) two real solutions

27. $2\sin^{-1} x = \cos^{-1}\left(1-2x^2\right)$ is true for
(1) all values of x (2) $-1 \le x \le 0$
(3) $0 \le x \le 1$ (4) no value of x

28. If $2\tan^{-1}\left[\sqrt{\frac{a-b}{a+b}}.\tan\left(\frac{\theta}{2}\right)\right] = \cos^{-1}\left[\frac{2a+3b}{3a+2b}\right]$, then $\cos\theta$ is equal to
(1) 1/2 (2) 1/3
(3) 2/3 (4) 2*a*/3b

29. If $v\cos^{-1} x + \cos^{-1} y = \pi/2$ and $\tan^{-1} x + \tan^{-1} y = 0$ then $x^2 + xy + y^2$ is equal to
(1) 0 (2) $1/\sqrt{2}$
(3) 3/2 (4) 1/8

30. $\tan^{-1}\left(\frac{x\cos\theta}{1-x\sin\theta}\right) - \cot^{-1}\left(\frac{\cos\theta}{x-\sin\theta}\right)$ is equal to
(1) θ (2) $\pi/2-\theta$
(3) $\theta/2$ (4) $\pi/4-\theta/2$