MATHS

BOOKS - CENGAGE

INVERSE TRIGONOMETRIC FUNCTIONS

Solved Examples And Exercises

1. Find x satisfying $\left[\tan^{-1}x\right] + \left[\cot^{-1}x\right] = 2$, where $[.]$ represents the greatest integer function.

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2. Evaluate the following: (i)$\sin^{-1}\left(\frac{\sin\pi}{4}\right)$ (ii) $\cos^{-1}\left(\cos 2\frac{\pi}{3}\right)$ (iii) $\tan^{-1}\left(\frac{\tan\pi}{3}\right)$

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3. Evaluate the following: 1. $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$ 2. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ 3. $\tan^{-1}\left(\tan\frac{2\pi}{3}\right)$

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4. If $\cos^{-1}\lambda + \cos^{-1}\mu + \cos^{-1}\gamma = 3\pi$, then find the value of $\lambda\mu + \mu\gamma + \gamma\lambda$

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5. If $\sin^{-1}x_1 + \sin^{-1}x_2 + \ + \sin^{-1}x_n \leq -\frac{n\pi}{2}, n \in N, n = 2m + 1, m \geq 1,$ then find the value of $\frac{x_1^1 + x_3^3 + x_5^5 + ...(m+1)terms}{x_2^2 + x_4^4 + x_6^6 + ... mterms}$

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6. Find the values of a for which $\sin^{-1}x = |x - a|$ will have at least one solution.

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7. Find the value of $\sin^{-1}(\sin 5) + \cos^{-1}(\cos 10) + \tan^{-1}\{\tan(-6)\} + \cot^{-1}\{\cot(-10)\}$.

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8. Solve for x : $\sin^{-1}\left(\sin\left(\frac{2x^2+4}{1+x^2}\right)\right) < \pi - 3$

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9. Find the value of $\cos\left(2\cos^{-1}x + \sin^{-1}x\right)$ at $x = \frac{1}{5}$, where $0 \leq \pi$ and $-\frac{\pi}{2} \leq \sin^{-1}x \leq \frac{\pi}{2}$.

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10. The number of solutions of $\cos\left(2\sin^{-1}\left(\cot\left(\tan^{-1}\left(\sec\left(6\cos ec^{-1}x\right)\right)\right)\right)\right)+1=0$ where $x>0$ is

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11. Let $\cos^{-1}(x)+\cos^{-1}(2x)+\cos^{-1}(3x)be\pi$ If x satisfies the equation $ax^3+bx^2+cx-c_1=0$, then the value of $(b-a-c)$ is_____

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12. If $\frac{\cot^{-1}n}{\pi}>\frac{\pi}{6}, n\in N,$ then the maximum value of n is 6 (b) 7 (c) 5 (d) none of these

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13. If $\text{cosec}^{-1}(\text{cosec}x)$ and $\text{cosec}\left(\text{cosec}^{-1}x\right)$ are equal functions, then the maximum range of value of x is

A. A $[-\pi 2,-1]\cup[1,\pi 2]$ B $[-\pi 2,0)\cup[0,\pi 2]$ C $(-\infty,-1]\cup[1,\infty)$ D $[-1,0)\cup[0,1)$

B. null

C. null

D. null

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14. The value of $\sin^{-1}\left(\cot\left(\sin^{-1}\left(\frac{2-\sqrt{3}}{4}+\frac{\cos^{-1}\left(\sqrt{12}\right)}{4}+\sec^{-1}\sqrt{2}\right)\right)\right)$ *is*

(a)0 (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) none of these

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15. The value of $\cos^{-1}\sqrt{\frac{2}{3}} - \cos^{-1}\left(\frac{\sqrt{6}+1}{2\sqrt{3}}\right)$ is equal to (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{6}$

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16. The value of $\cos\left(\frac{1}{2}\cos^{-1}\left(\frac{1}{8}\right)\right)$ is (a) $\frac{3}{4}$ (b) $-\frac{3}{4}$ (c) $\frac{1}{16}$ (d) $\frac{1}{4}$

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17. If $\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = \tan^{-1}(-7)$, then x is

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18. Solve the equation $\sin^{-1}6x + \sin^{-1}6\sqrt{3}x = \frac{-\pi}{2}$.

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19. Let $f(x) = \sin x + \cos x + \tan x + \sin^{-1}x + \cos^{-1}x + \tan^{-1}x$. Then find the maximum and minimum values of $f(x)$.

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20. If the area enclosed by the curves $f(x) = \cos^{-1}(\cos x)$ and $g(x) = \sin^{-1}(\cos x)$ in $x \in [9\pi/4, 15\pi/4]$ is $a\pi^2/b$ (where a and b are coprime), then the value of b is ____

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21. $f(x) = \tan^{-1}x + \tan^{-1}\left(\frac{1}{x}\right)$; $g(x) = \sin^{-1}x + \cos^{-1}x$ are identical functions if

A. (A)$x \in R$ (B) $x > 0$ (C) $x \in [-1, 1]$ (D) $x \in [0, 1]$

B. null

C. null

D. null

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22. If $\sin^{-1}a + \sin^{-1}b + \sin^{-1}c = \pi$, then $a\sqrt{1 - a^2} + b\sqrt{1 - b^2} + c\sqrt{1 - c^2}$ is equal to (a)$a + b + c$ (b) $a^2b^2c^2$ (c)$2abc$ (d) $4abc$

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23. If $a\sin^{-1}x - b\cos^{-1}x = c$, then $a\sin^{-1}x + b\cos^{-1}x$ is equal to (a)0(b) $\frac{\pi ab + c(b - a)}{a + b}$ (c)$\frac{\pi}{2}$ (d) $\frac{\pi ab + c(a - b)}{a + b}$

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24. The solution of the inequality $(\log)_{\frac{1}{2}}\sin^{-1}x > (\log)_{1/2}\cos^{-1}x$ is $x \in \left[\frac{0,1}{\sqrt{2}}\right]$

(b) $x \in \left[\frac{1}{\sqrt{2}}, 1\right]$ $x \in \left(\frac{0,1}{\sqrt{2}}\right)$ (d) none of these

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25. For $0 < \theta < 2\pi$, $\sin^{-1}(\sin\theta) > \cos^{-1}(\sin\theta)$ is true when θ belongs to

A. (a) $\left(\frac{\pi}{4}, \pi\right)$ (b) $\left(\pi, \frac{3\pi}{2}\right)$ (c) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ (d) $\left(\frac{3\pi}{4}, 2\pi\right)$

B. null

C. null

D. null

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26. If $\sin^{-1}x - \cos^{-1}x = \frac{\pi}{6}$, then

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27. The number of integer x satisfying $\sin^{-1}|x-2| + \cos^{-1}(1-|3-x|) = \frac{\pi}{2}$ is

(a)1 (b) 2 (c)3 (d)4

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28. If $\tan^{-1}x + 2\cot^{-1}x = \frac{2\pi}{3}$, then x, is equal to (a) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$ (b) 3 (c) $\sqrt{3}$ (d) $\sqrt{2}$

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29. If $\cos\left(2\sin^{-1}x\right) = \frac{1}{9}$, then find the values of x

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30. Find the number of solution of $2\tan^{-1}(\tan x) = 6 - x$

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31. Find the value of $\sin\left(\frac{1}{4}\cos^{-1}\left(\frac{-1}{9}\right)\right)$

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32. Find the value of $\sin\left(\frac{1}{2}\cot^{-1}\left(-\frac{3}{4}\right)\right)$

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33. Solve $\sin^{-1}(1 - x) - 2\sin^{-1}x = \frac{\pi}{2}$

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34. Prove that: $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)=\frac{x}{2}, x \in \left(0, \frac{\pi}{4}\right)$

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35. Simplify $\sin\cot^{-1}\tan\cos^{-1}x, x > 0$

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36. Find $\frac{\tan^{-1}x}{\sqrt{a^2-x^2}}$ in terms of $\sin^{-1}$ where $x \in (0, a)$

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37. If $\tan^{-1}\left(x^2+3|x|-4\right)+\cot^{-1}\left(4\pi+\sin^{-1}\sin 14\right)=\frac{\pi}{2}$, *then* the value of $\sin^{-1}\sin 2x$ is

A. (a)$6-2\pi$ (b) $2\pi-6$ (c)$\pi-3$ (d) $3-\pi$

B. null

C. null

D. null

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38. If $2\tan^{-1}x + \frac{\sin^{-1}(2x)}{1+x^2}$ is independent of x, then

A. (a)$x \in (-1,1)$ (b) $x \in (-\infty,-1)$ (c) $x \in (1,\infty)$ (d) $x \in (0,1)$

B. null

C. null

D. null

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39. Equation $1 + x^2 + 2x\sin\left(\cos^{-1}y\right) = 0$ is satisfied by

A. (a) exactly one value of x (b) exactly two value of x (c) exactly one value of y (d) exactly two value of y

B. null

C. null

D. null

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40. If the equation $2^{\frac{2\pi}{\cos^{-1}x}} - \left(a + \frac{1}{2}\right)2^{\frac{\pi}{\cos^{-1}x}} - a^2 = 0$ has exactly one real solution the range of a is equal to

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41. Let $\alpha = som^{-1}\left(\frac{36}{85}\right), \beta = \cos^{-1}\left(\frac{4}{5}\right) and \gamma = \tan^{-1}\left(\frac{8}{15}\right)$ then

$\cot\alpha + \cot\beta + \cot\gamma = \cot\alpha\cot\beta\cot\gamma$ $\tan\alpha\tan\beta + \tan\beta\tan\gamma + \tan\alpha\tan\gamma = 1$

$\tan\alpha + \tan\beta + \tan\gamma = \tan\alpha\tan\beta\tan\gamma$ $\cot\alpha\cot\beta + \cot\beta\cot\gamma + \cot\alpha\cot\gamma = 1$

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42. If $S_n = \cot^{-1}(3) + \cot^{-1}(7) + \cot^{-1}(13) + \cot^{-1}(21) + \overset{..}{n}$ terms, then

$S_{10} = \tan^{-1}\left(\frac{5}{6}\right) S_\infty = \frac{\pi}{4}$ (c) $S_6 = \sin^{-1}\left(\frac{4}{5}\right)$ (d) $S_{20} = \cot^{-1}1.1$

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43. The value of $\tan\left[\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{2}{3}\right)\right]$ is $\frac{6}{17}$ (b) $\frac{7}{16}$ (c) $\frac{16}{7}$ (d) none of these

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44. If $\frac{\tan^{-1}\left(\sqrt{1+x^2}-1\right)}{x} = 4^0$ then

A. (a)$x = \tan 2^0$ (b) $x = \tan 4^0$ (c)$x = \frac{\tan 1}{4^0}$ (d) $x = \tan 8^0$

B. null

C. null

D. null

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45. The value of $2\tan^{-1}\left(\cos ec\tan^{-1}x - \tan\cot^{-1}x\right)$ is equal to (a)$\cot^{-1}x$ (b) $\frac{\cot^{-1}1}{x}$ (c)$\tan^{-1}x$ (d) none of these

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46. If $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution, then

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47. If $\sin^{-1}x + \sin^{-1}y = \frac{\pi}{2}$, $then \frac{1 + x^4 + y^4}{x^2 - x^2y^2 + y^2}$ is equal to

A. (a)1 (b) 2 (c) $\frac{1}{2}$ (d) none of these

B. null

C. null

D. null

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48. The value of $\frac{\alpha^3}{2}\cos ec^2\left(\frac{1}{2}\frac{\tan^{-1}\alpha}{\beta}\right) + \frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\left(\frac{\beta}{\alpha}\right)\right) isequal \rightarrow$

A. (a)$(\alpha + \beta)\left(\alpha^2 + \beta^2\right)$ (b) $(\alpha + \beta)\left(\alpha^2 - \beta^2\right)$ (c)$(\alpha + \beta)\left(\alpha^2 + \beta^2\right)$ (d) none of these

B. null

C. null

D. null

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49. There exists a positive real number of x satisfying $\cos\left(\tan^{-1}x\right) = x$. Then the value of $\cos^{-1}\left(\frac{x^2}{2}\right)$ is

A. (a) $\frac{\pi}{10}$ (b) $\frac{\pi}{5}$ (c) $\frac{2\pi}{5}$ (d) $\frac{4\pi}{5}$

B. null

C. null

D. null

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50. The value of $\tan\left(\sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right)\right)\tan\left(\cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right)\right)$, *where* $x \in (0, 1)$, is equal to

A. (a) 0 (b) 1 (c) -1 (d) none of these

B. null

C. null

D. null

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51. The solution set of inequality $\left(\cot^{-1}x\right)\left(\tan^{-1}x\right) + \left(2 - \frac{\pi}{2}\right)\cot^{-1}x - 3\tan^{-1}x - 3\left(2 - \frac{\pi}{2}\right) > 0$ is (a, b), then the value of $\cot^{-1}a + \cot^{-1}b$ is____

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52. If $x = \sin^{-1}\left(a^6 + 1\right) + \cos^{-1}\left(a^4 + 1\right) - \tan^{-1}\left(a^2 + 1\right), a \in R,$ then the value of $\sec^2 x$ is_____

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53. The number of values of x for which $\sin^{-1}\left(x^2 - \frac{x^4}{3} + \frac{x^6}{9}\right) + \cos^{-1}\left(x^4 - \frac{x^8}{3} + \frac{x^{12}}{9}..\right) = \frac{\pi}{2},$ where `0lt=|x|

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54. Find the range of $\cot^{-1}\left(2x - x^2\right)$

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55. If $\frac{\tan^{-1}(a + x)}{a} + \frac{\tan^{-1}(a - x)}{a} = \frac{\pi}{6}, then x^2 =$ (a)$2\sqrt{3}a$ (b) $\sqrt{3}a$ (c) $2\sqrt{3}a^2$ (d) none of these

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56. The value of $k(k > 0)$ such that the length of the longest interval in which the function $f(x) = \sin^{-1}|\sin kx| + \cos^{-1}(\cos kx)$ is constant is $\frac{\pi}{4}$ is/ are

(a)8 (b) 4 (c) 12 (d) 16

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57. Which of the following pairs of function/functions has same graph?

$y = \tan\left(\cos^{-1}x\right); y = \frac{\sqrt{1 - x^2}}{x}$ $y = tan\left(\cot^{-1}x\right); y = \frac{1}{x}$

$y = \sin\left(\tan^{-1}x\right); y = \frac{x}{\sqrt{1 - x^2}}$ $y = \cos\left(\tan^{-1}x\right); y = s \in \left(\cot^{-1}x\right)$

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58. If $\cot^{-1}\left(\frac{n^2 - 10n + 21.6}{\pi}\right) > \frac{\pi}{6}$, where $xy < 0$ then the possible values of n is (a)3 (b) 2 (c) 4 (d) 8

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59. If $z = \sec^{-1}\left(x + \frac{1}{x}\right) + \sec^{-1}\left(y + \frac{1}{y}\right)$, where $xy < 0$, then the possible values of z is (a) $\frac{8\pi}{10}$ (b) $\frac{7\pi}{10}$ (c) $\frac{9\pi}{10}$ (d) $\frac{21\pi}{20}$

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60. If $\left(\sin^{-1}x + \sin^{-1}w\right)\left(\sin^{-1}y + \sin^{-1}z\right) = \pi^2$, then $D = \left|x^{N_1}y^{N_3}z^{N_3}w^{N_4}\right|\left(N_1, N_2, N_3, N_4 \in N\right)$ `

A. 16 different D are possible has a minimum value of -2

B. has a maximum value of 2 has a maximum value of 0

C. null

D. null

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61. Indicate the relation which can hold in their respective domain for infinite values of x (a) $\tan\left|\tan^{-1}x\right| = |x|$ (b) $\cot\left|\cot^{-1}x\right| = |x|$ $\tan^{-1}|\tan x| = |x|$ (d) $\sin\left|\sin^{-1}x\right| = |x|$

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62. If $x < 0$, *then* $\tan^{-1}x$ is equal to

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63. If $-1 < x < 0$, then $\cos^{-1}x$ is equal to (a) $\sec^{-1}\left(\frac{1}{x}\right)$ (b) $\pi - \sin^{-1}\sqrt{1+x^2}$ (c) $\pi + \tan^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)$ (d) $\cot^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)$.

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64. If $\tan^{-1}\left(x+\frac{3}{x}\right)-\tan^{-1}\left(x-\frac{3}{x}\right)=\frac{\tan^{-1}6}{x}$, then the value of x^4 is____.

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65. If $\cos^{-1}x+\cos^{-1}y+\cos^{-1}z=\pi$, *then* $x^2+y^2+z^2+2xyz=1$

$2\left(\sin^{-1}x+\sin^{-1}y+\sin^{-1}z\right)=\cos^{-1}x+\cos^{-1}y+\cos^{-1}z$

$xy+yz+zx=x+y+z-1\left(x+\frac{1}{x}\right)+\left(y+\frac{1}{y}\right)+\left(z+\frac{1}{z}\right)\geq 6$

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66. If $\alpha\in\left(-\frac{3\pi}{2},-\pi\right)$, then the value of $\tan^{-1}(\cot\alpha)-\cot^{-1}(\tan\alpha)+\sin^{-1}(\sin\alpha)+\cos^{-1}(\cos\alpha)$ is equal to (a)$2\pi+\alpha$ (b) $\pi+\alpha$ (c) 0 (d) $\pi-\alpha$

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67. $\tan^{-1}\left[\frac{\cos x}{1+\sin x}\right]$ is equal to $\frac{\pi}{4}-\frac{x}{2}, f \text{ or } x \in \left(-\frac{\pi}{2}, \frac{3\pi}{2}\right)$

$\frac{\pi}{4}-\frac{x}{2}, f \text{ or } x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ $\frac{\pi}{4}-\frac{x}{2}, f \text{ or } x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

$\frac{\pi}{4}-\frac{x}{2}, f \text{ or } x \in \left(-\frac{3\pi}{2}, \frac{\pi}{2}\right)$

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68. The value of the expression $\sin^{-1}\left(\frac{\sin(22\pi)}{7}\right)+\cos^{-1}\left(\frac{\cos(5\pi)}{3}\right)+\tan^{-1}\left(\frac{\tan(5\pi)}{7}\right)+\sin^{-1}(\cos 2)$ is (a) $\frac{17\pi}{42}-2$ (b) -2 (c) $\frac{-\pi}{21}-2$ (d) *noneofthese*

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69. The value of $\sin^{-1}\left(\cos\left(\cos^{-1}(\cos x)+\sin^{-1}(\sin x)\right)\right)$, where $x \in \left(\frac{\pi}{2}, \pi\right)$, is equal to (a) $\frac{\pi}{2}$ (b) $-\pi$ (c) π (d) $-\frac{\pi}{2}$

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70. Complete solution set of $\tan^2\left(\sin^{-1}x\right) > 1$ is (a) $\left(-1, -\frac{1}{\sqrt{2}}\right) \cup \left(\frac{1}{\sqrt{2}}, 1\right)$ (b) $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \sim \{0\}$ (c) $(-1, 1) \sim \{0\}$ (d) none of these

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71. The value of $\sin^{-1}(\sin 12) + \sin^{-1}(\cos 12) =$

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72. The range of the values of p for which the equation $\sin\cos^{-1}\left(\cos\left(\tan^{-1}x\right)\right) = p$ has a solution is

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73. The sum of the solution of the equation $2\sin^{-1}\sqrt{x^2+x+1}+\cos^{-1}\sqrt{x^2+x}=\frac{3\pi}{2}$ is (a)0 (b) -1 (c) 1 (d) 2

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74. Complete solution set of $\left[\cot^{-1}x\right]+2\left[\tan^{-1}x\right]=0,$ where [] denotes the greatest integer function, is equal to (a)$(0, \cot 1)$ (b) $(0, \tan 1)$ $(\tan 1, \infty)$ (d) $(\cot 1, \tan 1)$

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75. The number of integer values of k for which the equation $\sin^{-1}x+\tan^{-1}x=2k+1$ has a solution is (a)1 (b) 2 (c) 3 (d) 4

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76. The maximum value of $f(x) = \tan^{-1}\left(\frac{\left(\sqrt{12}-2\right)x^2}{x^4+2x^2+3}\right)$ is (A) 18° (B) 36° (C) 22.5° (D) 15°

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77. $\sec^2\left(\tan^{-1}2\right) + \operatorname{cosec}^2\left(\cot^{-1}3\right)$ is equal to (a)5 (b) 13 (c) 15 (d) 6

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78. The number of real solution of the equation $\tan^{-1}\sqrt{x^2-3x+7} + \cos^{-1}\sqrt{4x^2-x+3} = \pi$ is

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79. For the equation $\cos^{-1}x + \cos^{-1}2x + \pi = 0$, the number of real solution is (A)1 (B) 2 (C) 0 (D) ∞

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80. If $\sin^{-1}x = \theta + \beta and \sin^{-1}y = \theta - \beta,$ then $1 + xy$ is equal to

A. (a)$\sin^2\theta + \sin^2\beta$ (b) $\sin^2\theta + \cos^2\beta$ (c)$\cos^2\theta + \cos^2\theta$ (d) $\cos^2\theta + \sin^2\beta$

B. null

C. null

D. null

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81. If $\sin^{-1}(x - 1) + \cos^{-1}(x - 3) + \tan^{-1}\left(\frac{x}{2 - x^2}\right) = \cos^{-1}k + \pi,$ then the value of k is (a)1 (b) $-\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{2}}$ (d) non of these

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82. The value of $(\lim)_{x\to\infty}\left(\tan^{-1}x\right)\Big)\Big)$ is equal to (a) - 1 (b) $\frac{\pi}{2}$ (c) $-\frac{1}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{2}}$

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83. Range of $f(x) = \sin^{-1}x + \tan^{-1}x + \sec^{-1}x$ is (a) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ (b) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ (c) $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$ (d) none of these

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84. If $\left[\cot^{-1}x\right] + \left[\cos^{-1}x\right] = 0$, where [] denotes the greatest integer functions, then the complete set of values of x is (a)$(\cos 1, 1)$ (b) $\cos 1, \cos 1)$ $(\cot 1, 1)$ (d) none of these

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85. Range of $\tan^{-1}\left(\frac{2x}{1+x^2}\right)$ is (a) $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$ (b) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (c) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$ (d) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

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86. If range of function $f(x) = \sin^{-1}x + 2\tan^{-1}x + x^2 + 4x + 1$ is $[p, q]$, then the value of $(p + q)$ is_____>

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87. The value of x for which $\sin\left(\cot^{-1}(1+x)\right) = \cos\left(\tan^{-1}x\right)$ is (a) $\frac{1}{2}$ (b) 1 (c) 0 (d) $-\frac{1}{2}$

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88. The least and the greatest values of $\left(\sin^{-1}x\right)^3+\left(\cos^{-1}x\right)^3$ are (a) $\frac{-\pi}{2},\frac{\pi}{2}$ (b) $\frac{-\pi^3}{8},\frac{\pi^3}{8}$ (c) $\frac{\pi^3}{32},\frac{7\pi^3}{8}$ (d) none of these

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89. $\sin\left\{2\left(\frac{\sin^{-1}\left(\sqrt{5}\right)}{3}-\frac{\cos^{-1}\left(\sqrt{5}\right)}{3}\right)\right\}$ is equal to $\frac{k\sqrt{5}}{81}$ then $k=$

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90. If $0<x<1$, then $\sqrt{1+x^2}\left[\left\{x\cos\left(\cot^{-1}x\right)+\sin\left(\cot^{-1}x\right)\right\}^2-1\right]^{\frac{1}{2}}$ is equal to

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91. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is (a)1 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

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92. The number of real solutions of $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is

A. a.*zero* b. one c. two d. infinite

B. null

C. null

D. null

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93. Which of the following quantities is/are positive? (a)$\cos\left(\tan^{-1}(tan4)\right)$ (b) $\sin\left(\cot^{-1}(\cot 4)\right)$ $\tan\left(\cos^{-1}(\cos 5)\right)$ (d) $\cot\left(\sin^{-1}(\sin 4)\right)$

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94. If $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-\ldots.\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}-\ldots.\right)=\frac{\pi}{2}$ for $0<|x|<\sqrt{2}$ then $x=$

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95. If we consider only the principal values then the value inverse trigonometric functions then the value of $\left(\cos^{-1}\left(\frac{1}{5\sqrt{2}}\left(-\sin^{-1}\right)\frac{4}{\sqrt{17}}\right)\right.$ is

(a) $\frac{\sqrt{29}}{3}$ (b) $\frac{29}{3}$ (c) $\frac{\sqrt{3}}{29}$ (d) $\frac{3}{29}$

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96. The number of real solution of the equation $\sqrt{1+\cos 2x} = \sqrt{2}\sin^{-1}(\sin x), \ -\pi < x < \pi$is

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97. The solution set of the equation $\sin^{-1}\sqrt{1-x^2} + \cos^{-1}x = \frac{\cot^{-1}\left(\sqrt{1-x^2}\right)}{x} - \sin^{-1}x$ is (a)$[-1, 1] - \{0\}$ (b) $(0, 1) \cup \{-1\}$ (c)$[-1, 0) \cup \{1\}$ (d) $[-1, 1]$

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98. If `|cos^(-1)((1-x^2)/(1+x^2))|

A.

B. null

C. null

D. null

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99. The equation $3^{-1}x - \pi x - \frac{\pi}{2} = 0$ has one negative solution one positive solution no solution more than one solution

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100. If $\alpha, \beta(\alpha < \beta)$ are the roots of equation $6x^2 + 11 = x + 3 = 0$, then which following real? (a) $\cos^{-1}\alpha$ (b) $\sin^{-1}\beta$ (c) $\operatorname{cosec}^{-1}\alpha$ (d) both $\cot^{-1}\alpha$ and $\cot^{-1}\beta$

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101. If $2^{\frac{2\pi}{\sin^{-1}x}} - 2(a+2)^{\frac{\pi}{\sin^{-1}x}} + 8a < 0$ for at least one real x, then

(a) $\frac{1}{8} \leq a < 2$

(b) $a < 2$

(c) $a \in R - \{2\}$

(d) $a \in \left[0, \frac{1}{8}\right] \cup (2, \infty)$

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102. Which of the following is/are the value of $\cos\left[\frac{1}{2}\cos^{-1}\left(\cos\left(-\frac{14\pi}{5}\right)\right)\right]$? $\cos\left(-\frac{7\pi}{5}\right)$ (b) $\sin\left(\frac{\pi}{10}\right)$ $\cos\left(\frac{2\pi}{5}\right)$ (d) $-\cos\left(\frac{3\pi}{5}\right)$

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103. $2\tan^{-1}(-2)$ is equal to (a) $-\cos t^{-1}\left(\frac{-3}{5}\right)$ (b) $-\pi + \frac{\cos^{-1}3}{5}$ (c) $-\frac{\pi}{2} + \tan^{-1}\left(-\frac{3}{4}\right)$ (d) $-\pi\cot^{-1}\left(-\frac{3}{4}\right)$

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104. If the equation $\sin^{-1}\left(x^2+x+1\right)+\cos^{-1}(\lambda+1)=\frac{\pi}{2}$ has exactly two solutions for $\lambda \in [a, b]$, then the value of $a+b$ is

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105. Prove that : $\cos\left[\tan^{-1}\left\{\sin\left(\cot^{-1}x\right)\right\}\right]=\sqrt{\frac{x^2+1}{x^2+2}}$

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106. Find the minimum value of the function $f(x)=\frac{\pi^2}{16\cot^{-1}(-x)}-\cot^{-1}x$

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107. Find the range of $y=\left(\cot^{-1}x\right)\left(\cot^{-1}(-x)\right)$

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108. If $x \in [-1, 0]$, then find the value of $\cos^{-1}\left(2x^2 - 1\right) - 2\sin^{-1}x$

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109. Prove that: $\sin^{-1}\left\{\frac{\sqrt{1+x} + \sqrt{1-x}}{2}\right\} = \frac{\pi}{4} + \frac{\cos^{-1}x}{2}, 0 < x < 1$

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110. Prove that $\cos^{-1}\left(\frac{1 - x^{2n}}{1 + x^{2n}}\right) = 2\tan^{-1}x^n, 0 < x < \infty$

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111. Prove that $\cos^{-1}\left\{\frac{1+x}{2}\right\} = \frac{\cos^{-1}x}{2}$

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112. Prove that $\tan^{-1}\left\{\frac{x}{a+\sqrt{a^2-x^2}}\right\}=\frac{1}{2}\frac{\sin^{-1}x}{a},\ -a<x<a$

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113. Prove that: $\text{cosec}\left(\tan^{-1}\left(\cos\left(\cot^{-1}\left(\sec\left(\sin^{-1}a\right)\right)\right)\right)\right)=\sqrt{3-a^2},$ where $a\in[0,1]$

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114. If $x<0$, then prove that $\cos^{-1}x=\pi-\sin^{-1}\sqrt{1-x^2}$

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115. If $\cos^{-1}x-\frac{\cos^{-1}y}{2}=\alpha, then 4x^2-4xy\cos\alpha+y^2$ is equal to (a)4 (b) $2\sin^2\alpha$ (c) $-4\sin^2\alpha$ (d) $4\sin^2\alpha$

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116. If

$\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$, $then x^4 + y^2 + z^4 + 4x^2y^2z^2 = K\left(x^2y^2 + y^2z^2 + z^2x^2\right)$

where K is equal to 1 (b) 2 (c) 4 (d) none of these

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117. If $f(x) = \sin^{-1}\left(\frac{\sqrt{3}}{2}x - \frac{1}{2}\sqrt{1 - x^2}\right)$, $-\frac{1}{2} \leq x \leq 1$, $then f(x)$ is equal to

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118. Let $\begin{vmatrix} \tan^{-1}x & \tan^{-1}2x & \tan^{-1}3x \\ \tan^{-1}3x & \tan^{-1}x & \tan^{-1}2x \\ \tan^{-1}2x & \tan^{-1}3x & \tan^{-1}x \end{vmatrix} = 0$, then the number of values of x satisfying the equation is (a) 1 (b) 2 (c) 3 (d) 4

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119. If $x_1 = 2\tan^{-1}\left(\frac{1+x}{1-x}\right), x_2 = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, where $x \in (0, 1)$, then $x_1 + x_2$ is equal to 0 (b) 2π (c) π (d) none of these

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120. If $u = \cot^{-1}\sqrt{\tan\alpha} - \tan^{-1}\sqrt{\tan\alpha}$, $then \tan\left(\frac{\pi}{4} - \frac{u}{2}\right) isequal$ (a)$\sqrt{\tan\alpha}$ (b) $\sqrt{\cot\alpha}$ (c)$\tan\alpha$ (d) $\cot\alpha$

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121. If the equation $x^3 + bx^2 + cx + 1 = 0, (b < c)$, has only one real root α, then the value of $2\tan^{-1}(\cos ec\alpha) + \tan^{-1}\left(2\sin\alpha\sec^2\alpha\right)$ is

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122. The value of $\sin^{-1}\left[x\sqrt{1-x} - \sqrt{x}\sqrt{1-x^2}\right]$ is equal to

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123. Which of the following is the solution set of the equation $2\cos^{-1}x = \cot^{-1}\left(\frac{2x^2 - 1}{2x\sqrt{1 - x^2}}\right)$? (a)(0.1) (b) $(-1, 1) - \{0\}$ (c)$(-1, 0)$ (d) $(-1, 1)$

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124. The number of solution of equation $\sin^{-1}x + n\sin^{-1}(1 - x) = \frac{m\pi}{2}, where n > 0, m \leq 0,$ is 3 (b) 1 (c) 2 (d) None of these

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125. Number of solutions of equation $\sin\left(\cos^{-1}\left(\tan\left(\sec^{-1}x\right)\right)\right) = \sqrt{1 + x} is/are$ __

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126. Let $f:[0,4\pi] \to [0,\pi]$ be defined by $f(x) = \cos^{-1}(\cos x)$. The number of points $x \in [0,4\pi]$ 4satisfying the equation $f(x) = \frac{10 - x}{10}$ is

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127. The principal value of $\sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right)$ is (a)- $\frac{2\pi}{3}$ (b) $\frac{2\pi}{3}$ (c)$\frac{\pi}{3}$ (d) $\frac{5\pi}{3}$ (e) none of these

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128. If $\sec^{-1}x = \operatorname{cosec}^{-1}y$, then find the value of $\frac{\cos^{-1}1}{x} + \frac{\cos^{-1}1}{y}$.

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129. If $\alpha = \sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right) and \beta = \cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right)$, then find $\tan\alpha\tan\beta$

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130. If $\sin\left(\frac{\sin^{-1}1}{5} + \cos^{-1}x\right) = 1$, then find the value of x.

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131. If $\sin^{-1}x = \frac{\pi}{5}, f \text{ or } somex \in (-1, 1)$, then find the value of $\cos^{-1}x$

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132. Prove that $2\tan^{-1}\left(\text{cosec}\tan^{-1}x - \tan\cot^{-1}x\right) = \tan^{-1}x(x \neq 0)$

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133. Find the value of $\sin^{-1}(\sin 5) + \cos^{-1}(\cos 10) + \tan^{-1}\{\tan(-6)\} + \cot^{-1}\{\cot(-10)\}$.

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134. Solve $\frac{\sin^{-1}(14)}{|x|} + \frac{\sin^{-1}\left(2\sqrt{15}\right)}{|x|} = \frac{\pi}{2}$

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135. Find the minimum value of $\left(\sec^{-1}x\right)^2 + \left(\operatorname{cosec}^{-1}x\right)^2$

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136. Find the value of λ for which the four points with position vector $3\hat{i} - 2\hat{j} - \hat{k}, 2\hat{i} + 3\hat{j} - 4\hat{k}, -\hat{i} + \hat{j} + 2\hat{k} and 4\hat{i} + 5\hat{j} + \lambda\hat{k}$ are coplanar.

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137. Solve the following in equality $\sin^{-1}x \leq \cos^{-1}x$

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138. If $3\tan^{-1}\left(\frac{1}{2+\sqrt{3}}\right) - \frac{\tan^{-1}1}{x} = \frac{\tan^{-1}1}{3}$, then x is equal to 1 (b) 2 (c) 3 (d) $\sqrt{2}$

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139. The value $2\tan^{-1}\left[\sqrt{\frac{a-b}{a+b}}\frac{\tan\theta}{2}\right]$ is equal to (a)$\cos^{-1}\left(\frac{a\cos\theta+b}{a+b\cos\theta}\right)$ (b) $\cos^{-1}\left(\frac{a+b\cos\theta}{a\cos\theta+b}\right)$ $\cos^{-1}\left(\frac{a\cos\theta}{a+b\cos\theta}\right)$ (d) $\cos^{-1}\left(\frac{b\cos\theta}{a\cos\theta+b}\right)$

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140. If $\frac{1}{2}\sin^{-1}\left[\frac{3\sin 2\theta}{5+4\cos 2\theta}\right] = \tan^{-1}x$, *then* $x =$ (a) $\tan 3\theta$ (b) $3\tan\theta$ (c) $\left(\frac{1}{3}\right)\tan\theta$ (d) $3\cot\theta$

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141. If $\cot^{-1}\left(\sqrt{\cos\alpha}\right) - \tan^{-1}\left(\sqrt{\cos\alpha}\right) = x$, then $\sin x$ is $\frac{\tan^2\alpha}{2}$ (b) $\frac{\cot^2\alpha}{2}$ (c) $\tan^2\alpha$ (d) $\frac{\cot\alpha}{2}$

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142. The value of $\tan^{-1}\left(\frac{x\cos\theta}{1-x\sin\theta}\right) - \cot^{-1}\left(\frac{\cos\theta}{x-\sin\theta}\right)$ *is* 2θ (b) θ (c) $\frac{\theta}{2}$ (d) independent of θ

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143. $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x\right), x\neq 0,$ is equal to x (b) $2x$ (c) $\frac{2}{x}$

(d) none of these

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144. The sum of series $\sec^{-1}\sqrt{2}+\frac{\sec^{-1}\left(\sqrt{10}\right)}{3}+\frac{\sec^{-1}\left(\sqrt{50}\right)}{7}++\sec^{-1}\sqrt{\frac{\left(n^2+1\right)\left(n^2-2n+2\right)}{\left(n^2-n+1\right)^2}}$ is

(a)$\tan^{-1}n$ (b) n (c)$\tan^{-1}(n+1)$ (d) $\tan^{-1}(n-1)$

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145. The value of $\tan^{-1}.\frac{4}{7}+\tan^{-1}.\frac{4}{19}+\tan^{-1}.\frac{4}{39}+\tan^{-1}.\frac{4}{67}...\infty$ equals

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146. If

$$3\sin^{-1}\left(\frac{2x}{1+x^2}\right) - 4\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + 2\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \frac{\pi}{3}, \text{ where } |x| < 1,$$

then x is equal to (a) $\frac{1}{\sqrt{3}}$ (b) $-\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $-\frac{\sqrt{3}}{4}$

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147. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}x$, then x is equal to $[a, b, \in (0, 1)]$ (a) $\frac{a-b}{1+ab}$ (b) $\frac{b}{1+ab}$ (c) $\frac{b}{1+ab}$ (d) $\frac{a+b}{1-ab}$

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148. If $\alpha = \tan^{-1}\left(\frac{4x-4x^3}{1-6x^2+x^2}\right)$, $\beta = 2\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $\frac{\tan\pi}{8} = k$, then (a) $\alpha + \beta = \pi$ for $x \in \left[\frac{1,1}{k}\right]$ (b) $\alpha + \beta$ for $x \in (-k, k)$ (c) $\alpha + \beta = \pi$ for $x \in \left[\frac{1,1}{k}\right]$ (d) $\alpha + \beta = 0$ for $x \in [-k, k]$

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149. Absolute value of sum of all integers in the domain of $f(x) = \cot^{-1}\sqrt{(x+3)x} + \cos^{-1}\sqrt{x^2+3x+1}$ is_____

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150. Solve the equation $\tan^{-1}2x + \tan^{-1}3x = \frac{\pi}{4}$

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151. Solve $\tan^{-1}x + \sin^{-1}x = \tan^{-1}2x$.

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152. $2\tan\left(\tan^{-1}(x) + \tan^{-1}\left(x^3\right)\right)$, $where x \in R - \{-1, 1\}$, is equal to $\frac{2x}{1-x^2}$

$t\left(2\tan^{-1}x\right)\tan\left(\cot^{-1}(-x) - \cot^{-1}(x)\right)\tan\left(2\cot^{-1}x\right)$

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153. If $\alpha = 3\sin^{-1}\left(\frac{6}{11}\right)$ and $\beta = 3\cos^{-1}\left(\frac{4}{9}\right)$, where the inverse trigonometric functions take only the principal values, then the correct option(s) is (are)

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154. Prove that: $\tan^{-1}x + \frac{\tan^{-1}1}{x} = \begin{cases} \frac{\pi}{2}, & \text{if } x > 0 \\ -\frac{\pi}{2}, & \text{if } x < 0 \end{cases}$

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155. Find the value of $\sin^{-1}x + \frac{\sin^{-1}1}{x} + \cos^{-1}x + \frac{\cos^{-1}1}{x}$.

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156. Find the value of $\sum_{r=1}^{10}\sum_{s=1}^{10}\tan^{-1}\left(\frac{r}{s}\right)$

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157. If $\sin^{-1}x_i \in [0,1]\,\forall i = 1, 2, 3, .28$ then find the maximum value of $\sqrt{\sin^{-1}x_1}\sqrt{\cos^{-1}x_2} + \sqrt{\sin^{-1}x_2}\sqrt{\cos^{-1}x_3} + \sqrt{\sin^{-1}x_3}\sqrt{\cos^{-1}x_4} + \ + \sqrt{\sin^{-1}x_{28}}\sqrt{\cos^{-1}x_1}$

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158. Prove that $\frac{\cos^{-1}4}{5} + \frac{\cos^{-1}(12)}{13} = \frac{\cos^{-1}(33)}{65}$

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159. If two angles of a triangle are $\tan^{-1}(2) and \tan^{-1}(3)$, then find the third angle.

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160. Find the value of `tan^(-1)(1/2tan2A)+tan^(-1)(cotA)+tan^(-1)(cot^3A),

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161. Simplify tan^-1[3sin2α/(5+3 cos 2 α)] + tan-1[tanα/4] , where -π/2<α<π/2.

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162. $\sum_{r=1}^{n} \sin^{-1}\left(\frac{\sqrt{r}-\sqrt{r-1}}{\sqrt{r(r+1)}}\right)$ is equal to

(a) $\tan^{-1}\left(\sqrt{n}\right)-\frac{\pi}{4}$

(b) $\tan^{-1}\left(\sqrt{n+1}\right)-\frac{\pi}{4}$

(c) $\tan^{-1}\left(\sqrt{n}\right)$

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

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163. The greater of the two angles $A = 2\tan^{-1}\left(2\sqrt{2} - 1\right)$ and $B = 3\sin^{-1}\left(\frac{1}{3}\right) + \sin^{-1}\left(\frac{3}{5}\right)$ *is* ____.

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164. Find the value of $\tan\left(2\tan^{-1}\left(\frac{1}{5}\right) - \frac{\pi}{4}\right)$

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165. The value of α such that $\frac{\sin^{-1}2}{\sqrt{5}}, \frac{\sin^{-1}3}{\sqrt{10}}, \sin^{-1}\alpha$ are the angles of a triangle is $\frac{-1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{2}}$

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166. The number of solutions of the equation $\tan^{-1}(1+x)+\tan^{-1}(1-x)=\frac{\pi}{2}$ is 2 (b) 3 (c) 1 (d) 0

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167. If x, y, z are natural numbers such that $\cot^{-1}x+\cot^{-1}y=\cot^{-1}z$ then the number of ordered triplets (x, y, z) that satisfy the equation is (a)0 (b) 1 (c) 2 (d) Infinite solutions

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168. If $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\frac{\pi}{2}$, *then* (a) $x+y+z-xyz=0$ (b) $x+y+z+xyz=0$ (c) $xy+yz+zx+1=0$ (d)$xy+yz+zx-1=0$

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169. If $x^2 + y^2 + z^2 = r^2$, *then* $\tan^{-1}\left(\frac{xy}{zr}\right) + \tan^{-1}\left(\frac{yz}{xr}\right) + \tan^{-1}\left(\frac{xz}{yr}\right)$ is equal to (a)π (b) $\frac{\pi}{2}$ (c) 0 (d) none of these

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170. If $\cot^{-1}x + \cot^{-1}y + \cot^{-1}z = \frac{\pi}{2}, x, y, z > 0 and xy < 1,$ then $x + y + z$ is also equal to (a)$\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ (b) xyz (c) $xy + yz + zx$ (d) none of these

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171. If $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi, then$ (a)$x^2 + y^2 + z^2 + xyz = 0$ (b) $x^2 + y^2 + z^2 + 2xyz = 0$ (c) $x^2 + y^2 + z^2 + xyz = 1$ (d)$x^2 + y^2 + z^2 + 2xyz = 1$

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172. If $0 < \cos^{-1}x < 1$ and $1 + \sin\left(\cos^{-1}x\right) + \sin^2\left(\cos^{-1}x\right) + \sin^3\left(\cos^{-1}x\right).... + \infty = 2$, then the value of $12x^2$ is____.

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173. If $\cos^{-1}(x) + \cos^{-1}(y) + \cos^{-1}(z) = \pi\left(\sec^2(u) + \sec^4(v) + \sec^6(w)\right)$, where u , v , w are least non-negative angles such that u is less than v is less than w , then the value of $x^{2000} + y^{2000} + z^{2004} + \frac{36\pi}{u + v + w}$ is___

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174. The least value of $\left(1 + \sec^{-1}x\right)\left(1 + cas^{-1}x\right)$ is _____

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175. Find the value of $\frac{\cot^{-1}3}{4} + \frac{\sin^{-1}5}{13}$

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176. If $(x - 1)\left(x^2 + 1\right) > 0$, then find the value of $\sin\left(\frac{1}{2}\tan^{-1}.\frac{2x}{1 - x^2} - \tan^{-1}x\right)$

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177. Solve the following in equality $\sin^{-1}x \leq \cos^{-1}x$.

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178. Solve $\sin^{-1}x + \sin^{-1}2x = \frac{\pi}{3}$.

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179. If $a_1, a_2, a_3, \ldots . a_n$ is an arithmetic progression with common difference d. Prove that

$$\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right]=\frac{a_n-a}{1+a_1}$$

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180. If $x>y>z>0$, then find the value of

$$\frac{\cot^{-1}(xy+1)}{x-y}+\frac{\cot^{-1}(yz+1)}{zy-z}+\frac{\cot^{-1}(zx+1)}{z-x}$$

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181. Find the value of $4\frac{\tan^{-1}1}{5}-\frac{\tan^{-1}1}{70}+\frac{\tan^{-1}1}{99}$

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182. Find the value of $\sum_{r=0}^{\infty} \tan^{-1}\left(\frac{1}{1+r+r^2}\right)$

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183. If $x \in \left(0, \frac{\pi}{2}\right)$, then show that $\cos^{-1}\left(\frac{7}{2}(1+\cos 2x) + \sqrt{\left(\sin^2 x - 48\cos^2 x\right)\sin x}\right) = x - \cos^{-1}(7\cos x)$

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184. $\cos^{-1}\left\{\frac{1}{2}x^2 + \sqrt{1+x^2}\frac{\sqrt{1-x^2}}{4}\right\} = \frac{\cos^{-1}(x)}{2} - \cos^{-1}x$

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185. Find the range of $f(x) = \left|3\tan^{-1}x - \cos^{-1}(0)\right| - \cos^{-1}(-1)$

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186. Find the value of (i)$\sin^{-1}\left(2^{x}\right)$ (ii) $\cos^{-1}\sqrt{x^{2}-x+1}$ (iii) $\frac{\tan^{-1}\left(x^{2}\right)}{1+x^{2}}$ (iv) $\sec^{-1}\left(x+\frac{1}{x}\right)$

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187. Find the value of x for which $\operatorname{cosec}^{-1}(\cos x)$ is defined.

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188. Solve for x if $\left(\cot^{-1}x\right)^{2}-3\left(\cot^{-1}x\right)+2>0$

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189. Solve $\cos^{-1}x>\cos^{-1}x^{2}$

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190. Solve $\sin^{-1}x > 1$

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191. Find the principal value of the following (i)$\operatorname{cosec}^{-1}(2)$ (ii) $\tan^{-1}\left(-\sqrt{3}\right)$

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192. The product of all values of x satisfying the equation $\sin^{-1}\cos\left(\frac{2x^2+10|x|+4}{x^2+5|x|+3}\right)=\cot\left(\cot^{-1}\left(\frac{2-18|x|}{9|x|}\right)\right)+\frac{\pi}{2}$ is (a)9 (b) -9 (c) -3 (d) -1

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193. If $\tan^{-1}\left(\sin^2\theta - 2\sin\theta + 3\right) + \cot^{-1}\left(5\sin^{2\theta} + 1\right) = \frac{\pi}{2}$, then value of $2\cos^2\theta - \sin\theta$ is equal to 0 (b) -1 (c) 1 (d) none of these

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194. $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right)$ is (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{4}$ or $\frac{3\pi}{4}$

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195. The exhaustive set of value of a for which $a - \cot^{-1}3x = 2\tan^{-1}3x + \cos^{1}x\sqrt{3} + \sin^{-1}x\sqrt{3}$ *mayhave* solution, is $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

(b) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ (c) $\left[\frac{2\pi}{3}, \frac{4\pi}{3}\right]$ (d) $\left[-\frac{3\pi}{6}, \frac{7\pi}{6}\right]$

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196. Solve

$$\sin^{-1}\left(\frac{5}{x}\right)+\sin^{-1}\left(\frac{12}{x}\right)=\frac{\pi}{2}$$

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197. The value of a for which $ax^2+\sin^{-1}\left(x^2-2x+2\right)+\cos^{-1}\left(x^2-2x+2\right)=0$ has a real solution is $\frac{\pi}{2}$

(b) $-\frac{\pi}{2}$ (c) $\frac{2}{\pi}$ (d) $-\frac{2}{\pi}$

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198. If $\sin^{-1}\left(x^2-4x+5\right)+\cos^{-1}\left(y^2-2y+2\right)=\frac{\pi}{2}$ then find the value of $xandy$.

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199. Find the value of x for which $\sec^{-1}x + \sin^{-1}x = \frac{\pi}{2}$.

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200. Solve the equation $\sqrt{\left|\sin^{-1}|\cos x|\right| + \left|\cos^{-1}|\sin x|\right|} = \sin^{-1}|\cos x| - \cos^{-1}|\sin x|, \frac{-\pi}{2} \leq x \leq \frac{\pi}{2}$.

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201. If $p > q > 0$ and $pr < -1 < qr$, then find the value of $\tan^{-1}\left(\frac{p-q}{1+qr}\right) + \tan^{-1}\left(\frac{q-r}{1+qr}\right) + \tan^{-1}\left(\frac{r-p}{1+qr}\right)$

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202. Find the set of values of parameter a so that the equation $\left(\sin^{-1}x\right)^3 + \left(\cos^{-1}x\right)^3 = a\pi^3$ has a solution.

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203. Solve for real values of x: $\frac{\left(\sin^{-1}x\right)^3+\left(\cos^{-1}x\right)^3}{\left(\tan^{-1}x+\cot^{-1}x\right)^3}=7$

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204. If $x_1, x_2, x_3, and x_4$ are the roots of the equations $x^4 - x^3\sin2\beta + x^2\cos2\beta - x\cos\beta - \sin\beta = 0$, prove that $\tan^{-1}x_1 + \tan^{-1}x_2 + \tan^{-1}x_3 + \tan^{-1}x_4 = n\pi + \left(\frac{\pi}{2}\right) - \beta$, where n is an integer.

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205. If $\tan^{-1}y = 4\tan^{-1}x(|x|<\tan\left(\frac{\pi}{8}\right))$, find y as an algebraic function of x, *and*, hence, prove that $\tan\left(\frac{\pi}{8}\right)$ is a root of the equation $x^4 - 6x^2 + 1 = 0$

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206. Find the number of positive integral solution of the equation

$$\tan^{-1}x + \cos^{-1}\left(\frac{y}{\sqrt{1+y^2}}\right) = \sin^{-1}\left(\frac{3}{\sqrt{10}}\right)$$

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207. Find the sum

$$\operatorname{cosec}^{-1}\sqrt{10} + \operatorname{cosec}^{-1}\sqrt{50} + \operatorname{cosec}^{-1}\sqrt{170} + \ + \operatorname{cosec}^{-1}\sqrt{\left(n^2+1\right)\left(n^2+2n+2\right)}$$

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208. Find the domain for $f(x) = \sin^{-1}\left(\frac{1+x^2}{2x}\right)$

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209. If a, b, c be positive real numbers and the value of $\theta = \tan^{-1}\sqrt{\frac{a(a+b+c)}{bc}} + \tan^{-1}\sqrt{\frac{b(a+b+c)}{ca}} + \tan^{-1}\sqrt{\frac{c(a+b+a)}{(ab)}}$ then $\tan\theta$ is equal to

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210. If $f(x) = \sin^{-1}x$ then prove that $\lim_{x \to \frac{1}{2}} f\left(3x - 4x^3\right) = \pi - 3 \lim_{x \to \frac{1}{2}} \sin^{-1}x$

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211. Solve $\sin^{-1}x - \cos^{-1}x = \sin^{-1}(3x - 2)$

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212. Which of the following angles is greater?

$$\theta_1 = \sin^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{1}{3}\right) \text{ or } \theta_2 = \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{1}{3}\right)$$

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213. Find the value

$$\lim_{n \to \infty} \sum_{k=2}^{n} \cos^{-1}\left(\frac{1 + \sqrt{(k-1)k(k+1)(k+2)}}{k(k+1)}\right)$$

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214. If $\sin^{-1}\left(\frac{4x}{x^2+4}\right) + 2\tan^{-1}\left(-\frac{x}{2}\right)$ is independent of x, find the values of x.

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215. If $\frac{\cos^{-1}(6x)}{1+9x^2} = -\frac{\pi}{2} + \tan^{-1}3x$, then find the value of x.

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216. The greater of the two angles $A = 2\tan^{-1}\left(2\sqrt{2}-1\right)$ and $B = 3\sin^{-1}\left(\frac{1}{3}\right) + \sin^{-1}\left(\frac{3}{5}\right)$ is ____.

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217. Find the value of $2\frac{\cos^{-1}3}{\sqrt{13}} + \frac{\cot^{-1}(16)}{63} + \frac{1}{2}\frac{\cos^{-1}7}{25}$

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218. Prove that $2\cos^{-1}x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$

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Examples

1. Sove $2\cos^{-1}x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$

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2. Find the domain for $f(x) = \sin^{-1}\left(\frac{1+x^2}{2x}\right)$

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3. Find the range of $f(x) = \cot^{-1}\left(2x - x^2\right)$.

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4. Find the set of values of parameter a so that the equation $\left(\sin^{-1}x\right)^3 + \left(\cos^{-1}x\right)^3 = a\pi^3$ has a solution.

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5. Solve the equation $\sqrt{\left|s \in^{-1}\left|\cos\right|\right| + |\cos^{1}|\sin x|\Big|} = \sin^{-1}|\cos x| - \cos^{-1}|\sin x|, \frac{-\pi}{2} \leq x \leq \frac{\pi}{2}$.

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6. If`p > q >0a n dp r<-1“ ”

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7. $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{11}\right) =$

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8. Find the number of positive integral solution of the equation $\tan^{-1}x + \frac{\cos^{-1}y}{\sqrt{1-y^2}} = \frac{\sin^{-1}3}{\sqrt{10}}$

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9. If `tan^(-1)y=4tan^(-1)x(|x|

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10. Find the sum $\text{cosec}^{-1}\sqrt{10} + \text{cosec}^{-1}\sqrt{50} + \text{cosec}^{-1}\sqrt{170} + \ + \text{cosec}^{-1}\sqrt{\left(n^2+1\right)\left(n^2+2n+2\right)}$

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11. Let $f(x) = \sin x + \cos x + \tan x + \sin^{-1}x + \cos^{-1}x + \tan^{-1}x$. Then find the maximum and minimum values of $f(x)$.

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12. Find the principal value of the following:

(i) $\text{cosec}^{-1}(2)$ (ii) $\tan^{-1}\left(-\sqrt{3}\right)$ (iii) $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$

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13. Solver $\sin^{-1}x > -1$

Watch Video Solution

14. Solve $\cos^{-1}x > \cos^{-1}x^2$

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15. Solve for x if $\left(\cot^{-1}x\right)^2 - 3\left(\cot^{-1}x\right) + 2 > 0$

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16. Find the value of x for which the following expression are defined

(i) $\sin^{-1}(3x - 2)$ (ii) $\cos^{-1}\left(\log_e x\right)$ (iii) $\sec^{-1}\left(x^2 - 2\right)$

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17. If $\left[\cot^{-1}x\right] + \left[\cos^{-1}x\right] = 0$, where [] denotes the greatest integer functions, then the complete set of values of x is (a)$(\cos 1, 1)$ (b) $\cos 1, \cos 1)$ $(\cot 1, 1)$ (d) none of these

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18. Find the value of $\sin^{-1}\left(2^x\right)$ (ii) $\cos^{-1}\sqrt{x^2 - x + 1}$ $\frac{\tan^{-1}\left(x^2\right)}{1 + x^2}$ (iv) $\sec^{-1}\left(x + \frac{1}{x}\right)$

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19. Find the range of $f(x) = \left|3\tan^{-1}x - \cos^{-1}(0)\right| - \cos^{-1}(-1)$.

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20. Find the value of x for which $\sec^{-1}x\sin^{-1}x = \frac{\pi}{2}$.

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21. If $\sin^{-1}\left(x^2 + 2x + 2\right) + \tan^{-1}\left(x^2 - 3x - k^2\right) > \frac{\pi}{2}$, then find the values of k.

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22. If $\cos^{-1}\lambda\cos^{-1}\mu + \cos^{-1}\gamma = 3\pi$, then find the value of $\lambda\mu + \mu\lambda$.

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23. If $\sin^{-1}x_1 + \sin^{-1}x_2 + \ + \sin^{-1}x_n \leq \ = \frac{n\pi}{2}, n \in N, n = 2m + 1, m \geq 1,$ then find the value of $\frac{x11 + x33 + x55 + (m + 1)terms}{x22 + x44 + x66 + mterms}$

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24. Find x satisfying $\left[\tan^{-1}x\right] + \left[\cos^{-1}x\right] = 2,$ where [] represents the greatest integer function.

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25. If $\cos\left(2\sin^{-1}x\right) = \frac{1}{9},$ then find the value of x

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26. Find the value of $\sin\left(\frac{1}{2}\cot^{-1}\left(-\frac{3}{4}\right)\right)$

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27. Prove that: $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)=\frac{x}{2}, x \in \left(0, \frac{\pi}{4}\right)$

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28. Solve $\sin^{-1}(1-x)-2s \in^{-1} x=\frac{\pi}{2}$

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29. Find the solutions of the equation $\cos\left(\cos^{-1} x\right)=\operatorname{cosec}\left(\operatorname{cosec}^{-1} x\right)$.

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30. Find the principal values of the following

(i) $\sin^{-1}(\sin 1)$ (ii) $\sin^{-1}(\sin 2)$

(iii) $\sin^{-1}(\sin 10)$ (iv) $\sin^{-1}(\sin 20)$

(v) $\sin^{-1}(\sin 100)$ (vi) $\sin^{-1}\left(\sin . \frac{29\pi}{5}\right)$

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31. Solve $\sin^{-1}(\sin 6x) = x, x \in [0, \pi]$

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32. Solve `sin^(-1)[((2x^2+4)/(1+x^2))]

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33. Find the area bounded by $y\sin^{-1}(\sin x)$ and x-axis for $x \in [0, 100\pi]$

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34. Find the value of x for which $f(x) = 2\sin^{-1}\sqrt{1-x} + \sin^{-1}\left(2\sqrt{x-x^2}\right)$ is constant

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35. Find the principal value of the following

(i) $\cos^{-1}(\cos 3)$ (ii) $\cos^{-1}(\cos 4)$

(iii) $\cos^{-1}(\cos 15)$ (iv) $\cos^{-1}(\cos 30)$

(v) $\cos^{-1}(\cos 50)$ (vi) $\cos^{-1}\left(\cos.\ \frac{48\pi}{7}\right)$

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36. Solve $\cos^{-1}(\cos x) > \sin^{-1}(\sin x)$, $x \in [0, 2\pi]$

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37. Find $\tan^{-1}\tan\left(\frac{2\pi}{3}\right)$

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38. Find the number of solution of $2\tan^{-1}(\tan x) = 6 - x$

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39. Write $\tan^{-1}x, x > 0$ in the form of other inverse trigonometric function

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40. Find $\frac{\tan^{-1}x}{\sqrt{a^2 - x^2}}$ in terms of $\sin^{-1}$ where $x \in (0, a)$

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41. Prove that $\sin\left(\cot^{-1}\left(\tan\left(\cos^{-1}x\right)\right)\right) = x, x > 0$

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42. If $x < 0$, then prove that $\cos^{-1}x = \pi - \sin^{-1}\sqrt{1 - x^2}$

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43. Prove that $\cos^{-1}\left\{\frac{1 + x}{2}\right\} = \frac{\cos^{-1}x}{2}$

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44. Prove that `tan^(-1){x/(a+sqrt(a^2-x^2))}=1/2sin^(-1)x/a ,-a

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45. Prove that: $\sin^{-1}\left\{\frac{\sqrt{1 + x} + \sqrt{1 - x}}{2}\right\} = \frac{\pi}{4} + \frac{\cos^{-1}x}{2}, 0 < x < 1$

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46. Prove that $\cos^{-1}\left(\frac{1-x^{2n}}{1+x^{2n}}\right) = 2\tan^{-1}x^n, 0 < x < \infty$

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47. If $x \in [-1, 0]$, then find the value of $\cos^{-1}\left(2x^2 - 1\right) - 2\sin^{-1}x$

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48. If $\frac{1}{\sqrt{2}} < x < 1$, then prove that $\cos^{-1}x + \cos^{-1}\left(\frac{x+\sqrt{1-x^2}}{\sqrt{2}}\right) = \frac{\pi}{4}$

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49. Find the value of

$\sin^{-1}(\sin 5) + \cos^{-1}(\cos 10) + \tan^{-1}\{\tan(-6)\} + \cot^{-1}\{\cot(-10)\}$.

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50. Find the minimum value of the function $f(x) = \frac{\pi^2}{16\cot^{-1}(-x)} - \cot^{-1}x$

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51. Find the range of $y = \left(\cot^{-1}x\right)\left(\cot^{-1}(-x)\right)$

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52. Prove that $2\tan^{-1}\left(\operatorname{cosec}\tan^{-1}x - \tan\cot^{-1}x\right) = \tan^{-1}x (x \neq 0)$

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53. Prove that : $\cos\left[\tan^{-1}\left\{\sin\left(\cot^{-1}x\right)\right\}\right] = \sqrt{\frac{x^2+1}{x^2+2}}$

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54. If $\sin^{-1}x = \frac{\pi}{5}, f \text{ or } somex \in (-1, 1)$, then find the value of $\cos^{-1}x$.

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55. If $\sin\left(\sin^{-1}\frac{1}{5} + \cos^{-1}x\right) = 1$, then find the value of x.

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56. solve $\sin^{-1}x \leq \cos^{-1}x$

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57. Find the range of $f(x) = \sin^{-1}x + \tan^{-1}x + \cos^{-1}x$.

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58. Find the minimum value of $\left(\sec^{-1}x\right)^2+\left(\mathrm{cosec}^{-1}\right)^2$

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59. Find the range of $f(x)=\left(\sin^{-1}x\right)^2+2\pi\cos^{-1}x+\pi^2$

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60. Solve $\frac{\sin^{-1}(14)}{|x|}+\frac{\sin^{-1}\left(2\sqrt{15}\right)}{|x|}=\frac{\pi}{2}$

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61. If $\alpha=\sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right)and\beta=\cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right)$, then find $\tan\alpha\tan\beta$.

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62. If $\sec^{-1}x = \text{cosec}^{-1}y$, then find the value of $\frac{\cos^{-1}1}{x} + \frac{\cos^{-1}1}{y}$.

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63. Prove that $\tan^{-1}x + \tan^{-1}.\frac{1}{x} = \begin{cases} \pi/2 & \text{if} x > 0 \\ -\pi/2 & \text{if } x < 0 \end{cases}$

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64. Find the value of $\sin^{-1}x + \frac{\sin^{-1}1}{x} + \cos^{-1}x + \frac{\cos^{-1}1}{x}$.

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65. Find the value of $\sum_{r=1}^{10}\sum_{s=1}^{10}\tan^{-1}\left(\frac{r}{s}\right)$

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66. If $\sin^{-1}x_i \in [0, 1] \forall i = 1, 2, 3, .28$ then find the maximum value of $\sqrt{\sin^{-1}x_1}\sqrt{\cos^{-1}x_2} + \sqrt{\sin^{-1}x_2}\sqrt{\cos^{-1}x_3} + \sqrt{\sin^{-1}x_3}\sqrt{\cos^{-1}x_4} + + \sqrt{\sin^{-1}x_{28}}\sqrt{\cos^{-1}x_1}$

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67. If two angles of a triangle are $\tan^{-1}(2) and \tan^{-1}(3)$, then find the third angle.

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68. Prove that $\frac{\cos^{-1}4}{5}\frac{\cos^{-1}(12)}{13} = \frac{\cos^{-1}(33)}{65}$

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69. Find the value of `tan^(-1)(1/2tan2A)+tan^(-1)(cotA)+tan^(-1)(cot^3A),

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70. Let $a, bandc$ be positive real numbers. $lehη = \tan^{-1}\sqrt{\frac{a(a+b+c)}{bc}} + \tan^{-1}\sqrt{\frac{b(a+b+c)}{ca}} + \tan^{-1}\sqrt{\frac{c(a+b+c)}{ab}}$.

Then $\tan\theta$ = _____

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71. Simplify tan^-1[3sin2α/(5+3 cos 2 α)] + tan-1[tanα/4] , where -π/2<α<π/2.

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72. Solve : $\tan^{-1}2x + \tan^{-1}3x = \frac{\pi}{4}$

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73. Solve $\tan^{-1}x + \sin^{-1}x = \tan^{-1}2x$

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74. Solve $\cot^{-1}\left(\frac{3x^2+1}{x}\right) = \cot^{-1}\left(\frac{1-3x^2}{x}\right) - \tan^{-1}6x$

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75. If $x > y > z > 0$, then find the value of

$$\frac{\cot^{-1}(xy+1)}{x-y} + \frac{\cot^{-1}(yz+1)}{zy-z} + \frac{\cot^{-1}(zx+1)}{z-x}$$

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76. Solve $\tan^{-1}x + \cot^{-1}(-|x|) = 2\tan^{-1}6x$

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77. If $a_1, a_2, a_3, \ldots . a_n$ is an arithmetic progression with common difference d. Prove that

$$\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right]=\frac{a_n-a}{1+a_1}$$

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78. Find the value of $\sum_{r=0}^{\infty}\tan^{-1}\left(\frac{1}{1+r+r^2}\right)$

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79. Find the sum $\sum_{r=1}^{\infty}\tan^{-1}\left(\frac{2(2r-1)}{4+r^2\left(r^2-2r+1\right)}\right)$

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80. Find the value of $4\frac{\tan^{-1}1}{5}-\frac{\tan^{-1}1}{70}+\frac{\tan^{-1}1}{99}$

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81. If $(x - 1)\left(x^2 + 1\right) > 0$, then find the value of $\sin\left(\frac{1}{2}\frac{\tan^{-1}(2x)}{1 - x^2} - \tan^{-1}x\right)$

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82. Prove that

$$3\tan^{-1}x = \begin{cases} \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right) & \text{if } -\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}} \\ \pi + \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right) & \text{if } x > \frac{1}{\sqrt{3}} \\ -\pi + \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right) & \text{if } x < -\frac{1}{\sqrt{3}} \end{cases}$$

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83. Prove that $\cot^{-1}.\frac{3}{4} + \sin^{-1}.\frac{5}{13} = \sin^{-1}.\frac{63}{65}$

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84. Solve $\sin^{-1}x + \sin^{-1}2x = \frac{\pi}{3}$.

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85. Solve $\sin^{-1}x + \sin^{-1}(1 - x) = \cos^{-1}x$

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86. Solve : $\cos^{-1}\left(\frac{1}{2}x^2 + \sqrt{1 - x^2}1 = \frac{x^2}{4}\right) = \frac{\cos^{-1}x}{2} - \cos^{-1}x$.

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87. If $x \in \left(0, \frac{\pi}{2}\right)$, then show that

$$\cos^{-1}\left(\frac{7}{2}(1+\cos 2x)+\sqrt{\left(\sin^2 x-48\cos^2 x\right)\sin x}\right)=x-\cos^{-1}(7\cos x)$$

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88. Which of the following angles is greater?

$$\theta_1=\sin^{-1}+\frac{\sin^{-1}1}{3} \text{ or } \theta_2=\frac{\cos^{-1}4}{5}+\frac{\cos^{-1}1}{3}$$

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89. Find the value $\left(\lim\right)_{n\to\infty}\sum_{k=2}^{n}\left(\frac{1+\sqrt{(k-1)k(k+1)(k+2)}}{k(k+1)}\right)$

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90. If $f(x) = \sin^{-1}x$ then prove that $(\lim)_{n\frac{1}{2}}, f\left(3x - 4x^3\right) = \pi - 3(\lim)_{n\frac{1}{2}}, \sin^{-1}x$.

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91. Solve $\sin^{-1}x - \cos^{-1}x = \sin^{-1}(3x - 2)$

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92. $\sin\left\{2\cos^{-1}\left(\frac{-3}{5}\right)\right\} =$

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93. If $\frac{\sin^{-1}(2x)}{1 + x^2} = \frac{\tan^{-1}(2x)}{1 - x^2}$, then find the value of x.

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94. If $\sin^{-1}\left(\frac{4x}{x^2+4}\right)+2\tan^{-1}\left(-\frac{x}{2}\right)$ is independent of x, find the values of x.

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95. If $\frac{\cos^{-1}(6x)}{1+9x^2}=-\frac{\pi}{2}+\tan^{-1}3x$, then find the value of x.

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96. Find the value of $2\frac{\cos^{-1}3}{\sqrt{13}}+\frac{\cot^{-1}(16)}{63}+\frac{1}{2}\frac{\cos^{-1}7}{25}$

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Exercise 7.1

1. Find the principal value of (a) $\text{cosec}^{-1}(-1)$ (b) $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$

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2. Solves $\cos^{-1}x < 2$

A. $x \in (\cos 2, 2)$

B. $x \in (0, 1)$

C. $x \in (-1, 1)$

D. $x \in (\cos 2, 1)$

Answer: D

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3. Find the possible values of $\sin^{-1}(1-x) + \cos^{-1}\sqrt{x-2}$

A. 0

B. `{-1,1}

C. 2

D. -1/2

Answer: A

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4. Find the real values of x for which the function $f(x) = \cos^{-1}\sqrt{x^2 + 3x + 1} + \cos^{-1}\sqrt{x^2 + 3x}$ is defined

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5. Find the smallest and the largest values of $\tan^{-1}\left(\frac{1 - x}{1 + x}\right), 0 \leq x \leq 1$

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6. Find the value of x for which $\sin^{-1}\left(\cos^{-1}x\right) < 1$ and $\cos^{-1}\left(\cos^{-1}x\right) < 1$

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7. Solve $\sin^{-1}x > -1$

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8. Find the range of $f(x) = \sin^{-1}x + \tan^{-1}x + \cos^{-1}x$.

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9. If $\left(\sin^{-1}x\right)^2 + \left(\sin^{-1}y\right)^2 + \left(\sin^{-1}z\right)^2 = \frac{3}{4}\pi^2$, find the value of $x^2 + y^2 + z^2$.

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10. Find the value of $\sin\left(\frac{1}{4}\right)\cos^{-1}\left(\frac{-1}{9}\right)$

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11. If $x < 0$, then prove that $\cos^{-1}x = \pi + \tan^{-1}.\ \frac{\sqrt{1 - x^2}}{x}$

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12. Prove that $\sin^{-1}.\left(\left(x + \frac{\sqrt{1 - x^2}}{\sqrt{2}}\right) = \sin^{-1}x + \frac{\pi}{4}\right.$, where $-\frac{1}{\sqrt{2}} < x < \frac{1}{\sqrt{2}}$

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Exercise 7.2

1. Find the value of $\tan^{-1}\left(-\tan.\ \frac{13\pi}{8}\right) + \cot^{-1}\left(-\cot\left(\frac{19\pi}{8}\right)\right)$

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2. If $f(x) = \sin^{-1}\left(\sin\left(\log_2 x\right)\right)$, then find the value of $f(300)$

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3. find the maximum value of $f(x) = \left(\sin^{-1}(\sin x)\right)^2 - \sin^{-1}(\sin x)$

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4. solve $\sin^{-1}(\sin 5) > x^2 - 4x$

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5. Consider function $f(x) = \sin^{-1}(\sin x) + \cos^{-1}(\cos x)$, $x \in [0, 2\pi]$

(a) Draw the graph of $y = f(x)$

(b) Find the range of $f(x)$

(c) Find the area bounded by $y = f(x)$ and x-axis

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6. Find the value of x for which function are identical.

$f(x) = \tan^{-1}x + \frac{\tan^{-1}1}{x} and g(x) = \sin^{-1}x + \cos^{-1}x$

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Exercise 7.3

1. Express $\sin^{-1}.\frac{\sqrt{x}}{\sqrt{x+a}}$ as a function of $\tan^{-1}$

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2. If $\tan\left(\cos^{-1}x\right) = \sin\left(\cot^{-1}.\frac{1}{2}\right)$, then find the value of x

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3. Prove that: $\operatorname{cosec}\left(\tan^{-1}\left(\cos\left(\cot^{-1}\left(\sec\left(\sin^{-1}a\right)\right)\right)\right)\right) = \sqrt{3 - a^2}$, where $a \in [0, 1]$

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4. Prove that $\sin\left(\cot^{-1}\left(\tan\left(\cos^{-1}x\right)\right)\right) = x, x > 0$

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5. $\tan^{-1}\left(\frac{\sqrt{1 + a^2x^2} - 1}{ax}\right)$ where $x \neq 0$, is equal to

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6. Prove that $\sin\left[2\tan^{-1}\left\{\sqrt{\frac{1-x}{1+x}}\right\}\right] = \sqrt{1-x^2}$

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7. Prove that $\tan^{-1}.\frac{1}{\sqrt{x^2-1}} = \frac{\pi}{2} - \sec^{-1}x, x > 1$

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8. $y = \tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right), f \in d\frac{dy}{dx}.$

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9. If $x < 0$, the prove that $\cos^{-1}\left(\frac{1+x}{\sqrt{2\left(1+x^2\right)}}\right) = \frac{\pi}{4} - \tan^{-1}x$

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10. Find the value of $\tan^{-1}\left(-\tan.\frac{13\pi}{8}\right)+\cot^{-1}\left(-\cot\left(\frac{19\pi}{8}\right)\right)$

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11. The value of $\tan\left\{\left(\cos^{-1}\left(-\frac{2}{7}\right)-\frac{\pi}{2}\right)\right]$ is

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12. If $\tan^{-1}\left(\frac{1}{y}\right)=-\pi+\cot^{-1}y$, where $y=x^2-3x+2$, then find the value of x

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Exercise 7.4

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

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2. solve the equation $\cot^{-1}x + \tan^{-1}3 = \frac{\pi}{2}$

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3. Solve $2\cos^{-1}x + \sin^{-1}x = \frac{2\pi}{3}$

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4. Show that $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$.

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5. If $\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3}$ and $\cos^{-1}x - \cos^{-1}y = -\frac{\pi}{3}$ then the number of values of (x, y) is

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6. If $\left(\tan^{-1}x\right)^2 + \left(\cot^{-1}x\right)^2 = \frac{5\pi^2}{8}$ find x.

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7. Sove $\sec^{-1}x > \operatorname{cosec}^{-1}x$

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8. Solve $\tan^{-1}x > \cot^{-1}x$

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9. If α is the only real root of the equation $x^3 + bx^2 + cx + 1 = 0 (b < c)$, then the value of $\tan^{-1}\alpha + \tan^{-1}\left(\alpha^{-1}\right)$ is equal to :

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10. If $\alpha \in \left(-\frac{\pi}{2}, 0\right)$, then find the value of $\tan^{-1}(\cot\alpha) - \cot^{-1}(\tan\alpha)$

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11. Find the maximum value of $\left(\sec^{-1}x\right)\left(\operatorname{cosec}^{-1}x\right), x \geq 1$

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12. Solution of the equation $\sin\left(\sqrt{1 + \sin 2\theta}\right) = \sin\theta + \cos\theta$ is $(n \in Z)$

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Exercise 7.5

1. Find the value of $\sin^{-1}\left(\frac{3}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right)$

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2. If $x > y > 0$, then find the value of $\tan^{-1}.\frac{x}{y} + \tan^{-1}\left[\frac{x+y}{x-y}\right]$

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3. Prove that $\tan^{-1}.\frac{1}{\sqrt{2}} + \sin^{-1}.\frac{1}{\sqrt{5}} - \cos^{-1}.\frac{1}{\sqrt{10}} = -\pi + \cot^{-1}\left(\frac{1+\sqrt{2}}{1-\sqrt{2}}\right)$

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4. Solve : $\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$

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5. The number of real values of x satisfying

$$\tan^{-1}\left(\frac{x}{1-x^2}\right)+\tan^{-1}\left(\frac{1}{x^3}\right)=\frac{3\pi}{4} \text{ is}$$

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6. Prove : $2\sin^{-1}\frac{3}{5}=\tan^{-1}\frac{24}{7}$

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7. Find $\frac{dy}{dx}$ in the following :

$$y=\tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right),\ -\frac{1}{\sqrt{3}}<x<\frac{1}{\sqrt{3}}.$$

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8. Solve :

$2\tan^{-1}(\cos x) = \tan^{-1}(2\operatorname{cosec} x)$

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9. Solve the $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}x$ for $x > 0$.

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10. If $x + y + z = xyz$ and $x, y, z > 0$, then find the value of $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z$

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11. If α and $\beta(\alpha > \beta)$ are the roots of $x^2 + kx - 1 = 0$, then find the value of $\tan^{-1}\alpha - \tan^{-1}\beta$

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12. Find the sum $\cot^{-1}2 + \cot^{-1}8 + \cot^{-1}18 + \ldots\infty$

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13. Prove that $\sum_{r=1}^{n} \tan^{-1}\left(\frac{2^{r-1}}{1+2^{2r-1}}\right) = \tan^{-1}\left(2^n\right) - \frac{\pi}{4}$

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Exercise 7.6

1. If $\cos^{-1}.\frac{x}{2} + \cos^{-1}.(y).(3) = \frac{\pi}{6}$, then prove that $\frac{x^2}{4} - \frac{xy}{2\sqrt{3}} + \frac{y^2}{9} = \frac{1}{4}$

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2. Find the set of value of x for which the equation

$\cos^{-1}x + \cos^{-1}\left(\frac{x}{2} + \frac{1}{2}\sqrt{3 - 3x^2}\right) = \frac{\pi}{3}$ holds goods

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3. solve the following equation

$\sec^{-1}.\frac{x}{a} - \sec^{-1}.\frac{x}{b} = \sec^{-1}b - \sec^{-1}a, a \geq 1, b \geq 1, a \neq b$

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4. If $a^2 + b^2 = c^2, c \neq 0$, then find the non-zero solution of the equation:

$\sin^{-1}.\frac{ax}{c} + \sin^{-1}.\frac{bx}{c} = \sin^{-1}x$

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5. If $\cos(\theta - \alpha) = a$ and $\sin(\theta - \beta) = b(0 < \theta - \alpha, \theta - \beta < \pi/2)$, then prove that

$\cos^2(\alpha - \beta) + 2ab\sin(\alpha - \beta) = a^2 + b^2$

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6. Find the value of x which satisfy equation $2\tan^{-1}2x = \sin^{-1}.\frac{4x}{1+4x^2}$

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7. If $x \in (0, 1)$, then find the value of $\tan^{-1}\left(\frac{1-x^2}{2x}\right) + \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$

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8. If $x \in [-1, 0]$, then find the value of $\cos^{-1}\left(2x^2-1\right) - 2\sin^{-1}x$

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9. $\sin\left(2\sin^{-1}0.8\right) =$

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Exercise (Single)

1. $\cos^{-1}\left(\cos\left(2\cot^{-1}\left(\sqrt{2}-1\right)\right)\right)$ is equal to

A. $\sqrt{2}-1$

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

C. $\frac{3\pi}{4}$

D. none of these

Answer: C

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2. The value of $\sin^{-1}\left(\cot\left(\sin^{-1}\left(\frac{2-\sqrt{3}}{4}+\frac{\cos^{-1}\left(\sqrt{12}\right)}{4}+\sec^{-1}\sqrt{2}\right)\right)\right)$ *is* 0

(b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) none of these

A. 0

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

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

D. none of these

Answer: A

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3. If $\frac{\cot^{-1} n}{\pi} > \frac{\pi}{6}, n \in N,$ then the maximum value of n is 6 (b) 7 (c) 5 (d) none of these

A. 6

B. 7

C. 5

D. none of these

Answer: C

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4. If $\text{cosec}^{-1}(\text{cosec}x)$ and $\text{cosec}\left(\text{cosec}^{-1}x\right)$ are equal function then the maximum range of value of x is

A. $\left[-\frac{\pi}{2}, -1\right] \cup \left[1, \frac{\pi}{2}\right]$

B. $\left[-\frac{\pi}{2}, 0\right) \cup \left[0, \frac{\pi}{2}\right]$

C. $(-\infty, -1] \cup [1, \infty)$

D. $[-1, 0) \cup [0, 1)$

Answer: A

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5. $\sec^2\left(\tan^{-1}2\right) + \text{cosec}^2\left(\cot^{-1}3\right)$ is equal to (a)5 (b) 13 (c) 15 (d) 6

A. 5

B. 13

C. 15

D. 6

Answer: C

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6. The maximum value of $f(x) = \tan^{-1}\left(\frac{\left(\sqrt{12} - 2\right)x^2}{x^4 + 2x^2 + 3}\right)$ is (A) 18° (B) 36° (C) 22.5° (D) 15°

A. 18°

B. 36°

C. 22.5°

D. 15°

Answer: D

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7. For the equation $\cos^{-1}x + \cos^{-1}2x + \pi = 0$, the number of real solution is 1 (b) 2 (c) 0 (d) ∞

A. 1

B. 2

C. 0

D. ∞

Answer: C

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8. The number of real solution of the equation $\tan^{-1}\sqrt{x^2 - 3x + 2} + \cos^{-1}\sqrt{4x - x^2 - 3} = \pi$ is

A. one

B. two

C. zero

D. infinite

Answer: C

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9. If $\sin^{-1}(x-1)+\cos^{-1}(x-3)+\tan^{-1}\left(\frac{x}{2-x^2}\right)=\cos^{-1}k+\pi$, then the value of k is 1 (b) $-\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{2}}$ (d) non of these

A. 1

B. $-\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. none of these

Answer: C

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10. The number of real solution of the equation $\sqrt{1+\cos 2x} = \sqrt{2}\sin^{-1}(\sin x),\ -\pi < x < \pi$is

A. 0

B. 1

C. 2

D. infinite

Answer: C

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11. Find the set of value of x for which the equation $\cos^{-1}x + \cos^{-1}\left(\frac{x}{2} + \frac{1}{2}\sqrt{3-3x^2}\right) = \frac{\pi}{3}$ holds goods

A. one negative solution

B. one positive solution

C. no solution

D. more than one solution

Answer: B

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12. Range of $f(x) = \sin^{-1}x + \tan^{-1}x + \sec^{-1}x$ is $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ (b) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$ (d) none of these

A. $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

B. $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$

C. $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$

D. none of these

Answer: C

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13. The value of $\lim_{|x| \to \infty} \cos\left(\tan^{-1}\left(\sin\left(\tan^{-1}x\right)\right)\right)$ is equal to

A. -1

B. $\sqrt{2}$

C. $-\frac{1}{\sqrt{2}}$

D. $\frac{1}{\sqrt{2}}$

Answer: D

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14. Find the range of $\tan^{-1}\left(\frac{2x}{1+x^2}\right)$

A. $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

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

C. $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right]$

D. $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

Answer: A

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15. Complete solution set of $\left(\cot^{-1}x\right) + 2\left(\tan^{-1}x\right) = 0,$ where [] denotes the greatest integer function, is equal to $(0, \cot 1)$ (b) $(0, \tan 1)$ $(\tan 1, \infty)$ (d) $(\cot 1, \tan 1)$

A. $(0, \cot 1)$

B. $(0, \tan 1)$

C. $(\tan 1, \infty)$

D. $(\cot 1, \tan 1)$

Answer: D

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16. The number of integral values of k for which the equation $\sin^{-1}x + \tan^{-1}x = 2k + 1$ has a solution is 1 (b) 2 (c) 3 (d) 4

A. 1

B. 2

C. 3

D. 4

Answer: B

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17. The range of value of p for which the equation $\sin\cos^{-1}\left(\cos\left(\tan^{-1}x\right)\right) = p$ has a solution is $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right.$ (b) (0,1) $\left(\frac{1}{\sqrt{2}}, 1\right)$ (d) $(-1, 1)$

A. $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

B. $[0, 1)$

C. $\left(\frac{1}{\sqrt{2}}, 1\right)$

D. $(-1, 1)$

Answer: B

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18. The sum of the solution of the equation $2\sin^{-1}\sqrt{x^2+x+1} + \cos^{-1}\sqrt{x^2+x} = \frac{3\pi}{2}$ is (a)0 (b) -1 (c) 1 (d) 2

A. 0

B. -1

C. 1

D. 2

Answer: D

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19. Complete solution set of $\tan^2\left(\sin^{-1}x\right) > 1$ is (a) $\left(-1, -\frac{1}{\sqrt{2}}\right) \cup \left(\frac{1}{\sqrt{2}}, 1\right)$

(b) $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \sim \{0\}$ (c) $(-1, 1) \sim \{0\}$ (d) none of these

A. $\left(-1, -\frac{1}{\sqrt{2}}\right) \cup \left(\frac{1}{\sqrt{2}}, 1\right)$

B. $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) \sim \{0\}$

C. $(-1, 1) \sim \{0\}$

D. none of these

Answer: A

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20. If $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution, then

A. all real values

B. $|a| < \frac{1}{2}$

C. $|a| \leq \frac{1}{\sqrt{2}}$

D. $(1).\ (2) < |a| < \frac{1}{\sqrt{2}}$

Answer: C

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21. The number of solution of equation $\sin^{-1}x + n\sin^{-1}(1 - x) = \frac{m\pi}{2}, where n > 0, m \geq 0,$ is 3 (b) 1 (c) 2 (d) None of these

A. 3

B. 1

C. 2

D. none of these

Answer: D

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22. If `|cos^(-1)((1-x^2)/(1+x^2))|

A. $x \in \left[-\frac{1}{3}, \frac{1}{\sqrt{3}}\right]$

B. $x \in \left(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

C. $x \in \left(0, \frac{1}{\sqrt{3}}\right)$

D. none of these

Answer: B

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23. The value of $\sin^{-1}(\sin 12) + \cos^{-1}(\cos 12)$ is equal to

A. zero

B. $24 - 2\pi$

C. $4\pi - 24$

D. none of these

Answer: A

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24. The value of the expression $\sin^{-1}\left(\frac{\sin(22\pi)}{7}\right)\cos^{-1}\left(\frac{\cos(5\pi)}{3}\right) + \tan^{-1}\left(\frac{\tan(5\pi)}{7}\right) + \sin^{-1}(\cos 2)$ is $\frac{17\pi}{42} - 2$ (b) $-2\ \frac{-\pi}{21} - 2$ (d) *noneofthese*

A. $\frac{17\pi}{42} - 2$

B. -2

C. $\frac{-\pi}{21} - 2$

D. none of these

Answer: A

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25. The value of $\sin^{-1}\left(\cos\left(\cos^{-1}(\cos x) + \sin^{-1}(\sin x)\right)\right)$, where $x \in \left(\frac{\pi}{2}, \pi\right)$, is equal to (a) $\frac{\pi}{2}$ (b) $-\pi$ (c) π (d) $-\frac{\pi}{2}$

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

B. $-\pi$

C. π

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

Answer: D

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26. If $\alpha \in \left(-\frac{3\pi}{2}, -\pi\right)$, then the value of $\tan^{-1}(\cot\alpha) - \cot^{-1}(\tan\alpha) + \sin^{-1}(\sin\alpha) + \cos^{-1}(c0s\alpha)$ is equal to $2\pi + \alpha$ (b) $\pi + \alpha$ (c) 0 (d) $\pi - \alpha$

A. $2\pi + \alpha$

B. $\pi + \alpha$

C. 0

D. $\pi - \alpha$

Answer: C

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27. $\tan^{-1}\left[\frac{\cos x}{1 + \sin x}\right]$ is equal to

A. $\frac{\pi}{4} - \frac{x}{2}$, for $x \in \left(-\frac{\pi}{2}, \frac{3\pi}{2}\right)$

B. $\frac{\pi}{4} - \frac{x}{2}$, for $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

C. $\frac{\pi}{4}, \frac{x}{2}$, for $x \in \left(\frac{3\pi}{2}, \frac{5\pi}{2}\right)$

D. $\frac{\pi}{4} - \frac{x}{2}$, for $x \in \left(-\frac{3\pi}{2}, \frac{\pi}{2}\right)$

Answer: A

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28. If $f(x) = x^{11} + x^9 - x^7 + x^3 + 1$ and $f\left(\sin^{-1}(\sin 8) = \alpha, \alpha\right.$ is constant, then $f\left(\tan^{-1}(\tan 8)\right.$ is equal to α (b) $\alpha - 2$ (c) $\alpha + 2$ (d) $2 - \alpha$

A. α

B. $\alpha - 2$

C. $\alpha + 2$

D. $2 - \alpha$

Answer: D

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29. If $\sin^{-1}:[-1,1] \to \left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ and $\cos^{-1}:[-1,1] \to [0,\pi]$ be two bijective functions, respectively inverse of bijective functions $\sin:\left[\frac{\pi}{2}, \frac{3\pi}{2}\right] \to [-1, 10$ and $\cos:[0,\pi] \to [-1,1]$ then $\sin^{-1}x + \cos^{-1}x$ is

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

B. π

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

D. not a constant

Answer: D

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30. Which of the following is the solution set of the equation $2\cos^{-1}x = \cot^{-1}\left(\frac{2x^2-1}{2x\sqrt{1-x^2}}\right)$? (a)(0.1) (b) $(-1,1)-\{0\}$ (c)$(-1,0)$ (d) $(-1,1)$

A. $(0, 1)$

B. $(-1, 1) - \{0\}$

C. $(-1, 0)$

D. $[-1, 1]$

Answer: A

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31. Which of the following is empty set?

A. 0

B. 1

C. -1

D. none of these

Answer: B

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32. There exists a positive real number of x satisfying $\cos\left(\tan^{-1}x\right) = x$.

Then the value of $\cos^{-1}\left(\frac{x^2}{2}\right)$ is

A. $\frac{\pi}{10}$

B. $\frac{\pi}{5}$

C. $\frac{2\pi}{5}$

D. $\frac{4\pi}{5}$

Answer: C

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33. If $\frac{\tan^{-1}\left(\sqrt{1+x^2}-1\right)}{x} = 4^0$ then

A. $x = \tan 2^\circ$

B. $x = \tan 4^\circ$

C. $x = \tan(1/4)^\circ$

D. $x = \tan 8^\circ$

Answer: D

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34. The value of $\frac{\alpha^3}{2}\text{cosec}^2\left(\frac{1}{2}\frac{\tan^{-1}\alpha}{\beta}\right) + \frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\left(\frac{\beta}{\alpha}\right)\right) isequal \rightarrow$

A. $(\alpha - \beta)\left(\alpha^2 + \beta^2\right)$

B. $(\alpha + \beta)\left(\alpha^2 - \beta^2\right)$

C. $(\alpha + \beta)\left(\alpha^2 + \beta^2\right)$

D. none of these

Answer: C

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35. $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x\right), x \neq 0,$ is equal to x (b) $2x$ (c) $\frac{2}{x}$ (d) none of these

A. x

B. $2x$

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

D. none of these

Answer: C

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36. If $\sin^{-1}x+\sin^{-1}y=\frac{\pi}{2}, then \frac{1+x^4+y^4}{x^2-x^2y^2+y^2}$ is equal to

A. 1

B. 2

C. $\frac{1}{2}$

D. none of these

Answer: B

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37. Prove that $2\tan^{-1}\left(\text{cosec}\tan^{-1}x - \tan\cot^{-1}x\right) = \tan^{-1}x(x \neq 0)$.

A. $\cot^{-1}x$

B. $\cot^{-1}.\frac{1}{x}$

C. $\tan^{-1}x$

D. none of these

Answer: C

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38. If $\sin^{-1}a + \sin^{-1}b + \sin^{-1}c = \pi$, then $a\sqrt{1 - a^2} + b\sqrt{1 - b^2} + c\sqrt{1 - c^2}$ is equal to (a)$a + b + c$ (b) $a^2b^2c^2$ (c)$2abc$ (d) $4abc$

A. $2abc$

B. abc

C. $\frac{1}{2}abc$

D. $\frac{1}{3}abc$

Answer: A

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39. If $a\sin^{-1}x - b\cos^{-1}x = c$, then $a\sin^{-1}x + b\cos^{-1}x$ is equal to 0 (b) $\frac{\pi ab + c(b - a)}{a + b}$ $\frac{\pi}{2}$ (d) $\frac{\pi ab + c(a - b)}{a + b}$

A. 0

B. $\frac{\pi ab + c(b - a)}{a + b}$

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

D. $\frac{\pi ab + c(a - b)}{a + b}$

Answer: D

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40. The solution of the inequality $(\log)_{\frac{1}{2}}(\sin)_{\frac{1}{2}}\sin^{-1}x > (\log)_{1/2}\cos^{-1}x$ is

$x \in \left[\frac{0, 1}{\sqrt{2}}\right]$ (b) $x \in \left[\frac{1}{\sqrt{2}}, 1\right]$ $x \in \left(\frac{0, 1}{\sqrt{2}}\right)$ (d) none of these

A. $x \in \left[0, \frac{\pi}{\sqrt{2}}\right]$

B. $x \in \left(\frac{1}{\sqrt{2}}, 1\right]$

C. $x \in \left(0, \frac{1}{\sqrt{2}}\right)$

D. none of these

Answer: C

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41. For $0 < \theta < 2\pi$, $\sin^{-1}(\sin\theta) > \cos^{-1}(\sin\theta)$ is true when θ belongs to

A. $\left(\frac{\pi}{4}, \pi\right)$

B. $\left(\pi, \frac{3\pi}{2}\right)$

C. $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

D. $\left(\frac{3\pi}{4}, 2\pi\right)$

Answer: C

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42. If $\sin^{-1}x + \cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$, then x is equalt to

A. R

B. $[-1, 1]$

C. $[0, 1]$

D. ϕ

Answer: C

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43. Solve $\left(\tan^{-1}x\right)^2 + \left(\cot^{-1}x\right)^2 = \frac{5\pi^2}{8}$

A. $\left[-\frac{3}{4}, \frac{1}{4}\right]$

B. $\left[-\frac{3}{4}, \frac{3}{4}\right]$

C. $[-1, 1]$

D. $\left[-1, \frac{3}{4}\right]$

Answer: A

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44. The number of integer x satisfying $\sin^{-1}|x-2| + \cos^{-1}(1-|3-x|) = \frac{\pi}{2}$ is

1 (b) 2 (c) 3 (d) 4

A. 1

B. 2

C. 3

D. 4

Answer: B

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45. The number of solutions of the equation $\cos^{-1}\left(\frac{1+x^2}{2x}\right) - \cos^{-1}x = \frac{\pi}{2} + \sin^{-1}x$ is 0 (b) 1 (c) 2 (d) 3

A. 0

B. 1

C. 2

D. 3

Answer: B

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46. $f(x) = \tan^{-1}x + \tan^{-1}\left(\frac{1}{x}\right)$; $g(x) = \sin^{-1}x + \cos^{-1}x$ are identical functions if

A. $x \in R$

B. $x > 0$

C. $x \in [-1, 1]$

D. $x \in (0, 1]$

Answer: D

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47. The value of a for which $ax^2 + \sin^{-1}\left(x^2 - 2x + 2\right) + \cos^{-1}\left(x^2 - 2x + 2\right) = 1$ has a real solution is $\frac{\pi}{2}$

(b) $-\frac{\pi}{2}$ (c) $\frac{2}{\pi}$ (d) $-\frac{2}{\pi}$

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

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

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

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

Answer: B

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48. Solve

$$\sin^{-1}\left(\frac{5}{x}\right) + \sin^{-1}\left(\frac{12}{x}\right) = \frac{\pi}{2}$$

A. $\frac{7}{13}$

B. $\frac{4}{3}$

C. 13

D. $\frac{13}{7}$

Answer: C

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49. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is (a)1 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

A. 1

B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Answer: D

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50. If $\tan^{-1}\left(\sin^2\theta - 2\sin\theta + 3\right) + \cot^{-1}\left(5\sin^{2\theta} + 1\right) = \frac{\pi}{2}$, then value of $2\cos^2\theta - \sin\theta$ is equal to 0 (b) -1 (c) 1 (d) none of these

A. 0

B. -1

C. 1

D. none of these

Answer: C

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51. The product of all values of x satisfying the equation $\sin^{-1}\cos\left(\frac{2x^2 + 10|x| + 4}{x^2 + 5|x| + 3}\right) = \cot\left(\cot^{-1}\left(\frac{2 - 18|x|}{9|x|}\right)\right) + \frac{\pi}{2}$ is (a)9 (b) -9 (c) -3 (d) -1

A. 9

B. -9

C. -3

D. -1

Answer: A

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52. The exhaustive set of value of a for which $a - \cot^{-1}3x = 2\tan^{-1}3x + \cos^{1}x\sqrt{3} + \sin^{-1}x\sqrt{3}$ *mayhave* solution, is $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

(b) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ (c) $\left[\frac{2\pi}{3}, \frac{4\pi}{3}\right]$ (d) $\left[-\frac{3\pi}{6}, \frac{7\pi}{6}\right]$

A. $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

B. $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

C. $\left[\frac{2\pi}{3}, \frac{4\pi}{3}\right]$

D. $\left[-\frac{3\pi}{6}, \frac{7\pi}{6}\right]$

Answer: C

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53. If $u = \cot^{-1}\sqrt{\tan\alpha} - \tan^{-1}\sqrt{\tan\alpha}$, *then* $\tan\left(\frac{\pi}{4} - \frac{u}{2}\right)$ *isequal* (a) $\sqrt{\tan\alpha}$ (b) $\sqrt{\cot\alpha}$ (c) $\tan\alpha$ (d) $\cot\alpha$

A. $\sqrt{\tan\alpha}$

B. $\sqrt{\cot\alpha}$

C. $\tan\alpha$

D. $\cot\alpha$

Answer: A

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54. The solution set of the equation $\sin^{-1}\sqrt{1-x^2}+\cos^{-1}x=\frac{\cot^{-1}\left(\sqrt{1-x^2}\right)}{x}-\sin^{-1}x$ is (a)$[-1,1]-\{0\}$ (b) $(0,1)\cup\{-1\}$ (c)$[-1,0)\cup\{1\}$ (d) $[-1,1]$

A. $[-1,1]-\{0\}$

B. $(0,1]\cup\{-1\}$

C. $[-1,0)\cup\{1\}$

D. $[-1,1]$

Answer: C

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55. The value of $\cos^{-1}\sqrt{\frac{2}{3}}-\frac{\cos^{-1}\left(\sqrt{6}+1\right)}{2\sqrt{3}}$ is equal to $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{6}$

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

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

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

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

Answer: D

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56. $\theta = \tan^{-1}\left(2\tan^2\theta\right) - \tan^{-1}\left(\frac{1}{3}\tan\theta\right)$ then $\tan\theta =$

A. -2

B. -1

C. $2/3$

D. 2

Answer: A

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57. If $y = \tan^{-1}.\frac{1}{2} + \tan^{-1}b, (0b < 1)$ and $0 < y \leq \frac{\pi}{4}$, then the maximum value of b is

A. 1/2

B. 1/3

C. 1/4

D. 2/3

Answer: B

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58. If x, y, z are natural numbers such that $\cot^{-1}x + \cot^{-1}y = \cot^{-1}z$ then the number of ordered triplets (x, y, z) that satisfy the equation is (a)0 (b) 1 (c) 2 (d) Infinite solutions

A. 0

B. 1

C. 2

D. Infinite solution

Answer: D

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59. The value of α such that $\frac{\sin^{-1}2}{\sqrt{5}}, \frac{\sin^{-1}3}{\sqrt{10}}, \sin^{-1}\alpha$ are the angles of a triangle is $\frac{-1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{2}}$

A. $\frac{-1}{\sqrt{2}}$

B. $\frac{1}{2}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{\sqrt{2}}$

Answer: D

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60. The number of solutions of the equation $\tan^{-1}(1+x)+\tan^{-1}(1-x)=\frac{\pi}{2}$ is 2 (b) 3 (c) 1 (d) 0

A. 2

B. 3

C. 1

D. 0

Answer: C

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61. Arithmetic mean of the non-zero solutions of the equation $\tan^{-1}\left(\frac{1}{2x+1}\right)+\tan^{-1}\left(\frac{1}{4x+1}\right)=\tan^{-1}\left(\frac{2}{x^2}\right)$

A. 2

B. 3

C. 4

D. none of these

Answer: B

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62. If $\cot^{-1}x + \cot^{-1}y + \cot^{-1}z = \frac{\pi}{2}, x, y, z > 0 and xy < 1,$ then $x + y + z$ is also equal to (a) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ (b) xyz (c) $xy + yz + zx$ (d) none of these

A. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$

B. xyz

C. $xy + yz + zx$

D. none of these

Answer: B

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63. If $x^2 + y^2 + z^2 = r^2$, $then \tan^{-1}\left(\frac{xy}{zr}\right) + \tan^{-1}\left(\frac{yz}{xr}\right) + \tan^{-1}\left(\frac{xz}{yr}\right)$ is equal to (a)π (b) $\frac{\pi}{2}$ (c) 0 (d) none of these

A. π

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

C. 0

D. none of these

Answer: B

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64. The value of $\tan^{-1}\left(\frac{x\cos\theta}{1 - x\sin\theta}\right) - \cot^{-1}\left(\frac{\cos\theta}{x - \sin\theta}\right) is\ 2\theta$ (b) θ (c) $\frac{\theta}{2}$ (d) independent of θ

A. 2θ

B. θ

C. $\theta/2$

D. independent of θ

Answer: B

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65. If $\cot^{-1}\left(\sqrt{\cos\alpha}\right) - \tan^{-1}\left(\sqrt{\cos\alpha}\right) = x$, then $\sin x$ is $\frac{\tan^2\alpha}{2}$ (b) $\frac{\cot^2\alpha}{2}$ (c) $\tan^2\alpha$ (d) $\frac{\cot\alpha}{2}$

A. $\tan^2.\frac{\alpha}{2}$

B. $\cot^2.\frac{\alpha}{2}$

C. $\tan\alpha$

D. $\cot.\frac{\alpha}{2}$

Answer: A

Watch Video Solution

66. $\sum_{r=1}^{n} \sin^{-1}\left(\frac{\sqrt{r}-\sqrt{r-1}}{\sqrt{r(r+1)}}\right) isequa < o \quad \tan^{-1}\left(\sqrt{n}\right) - \frac{\pi}{4} \quad \tan^{-1}\left(\sqrt{n+1}\right) - \frac{\pi}{4}$

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

A. $\tan^{-1}\left(\sqrt{n}\right) - \frac{\pi}{4}$

B. $\tan^{-1}\left(\sqrt{n+1}\right) - \frac{\pi}{4}$

C. $\tan^{-1}\left(\sqrt{n}\right)$

D. $\tan^{-1}\left(\sqrt{n+1}\right)$

Answer: C

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67. $\sum_{m-1}^{n} \tan^{-1}\left(\frac{2m}{m^4+m^2+2}\right)$ is equal to

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

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

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

(d) none of these

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

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

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

D. none of these

Answer: A

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68. The value of $\frac{\tan^{-1}4}{7}+\frac{\tan^{-1}4}{19}+\frac{\tan^{-1}4}{39}+\frac{\tan^{-1}4}{67}+\infty equals$

$\tan^{-1}1+\frac{\tan^{-1}1}{2}+\frac{\tan^{-1}1}{3}$ $\tan^{-1}+\cot^{-1}3$ $\cot^{-1}1+\frac{\cot^{-1}1}{2}\frac{\cot^{-1}1}{3}$

$\cot^{-1}1+\tan^{-1}3$

A. $\tan^{-1}1 + \tan^{-1}.\frac{1}{2} + \tan^{-1}.\frac{1}{3}$

B. $\tan^{-1}1 + \cot^{-1}3$

$\cot^{-1} + \cot^{-1}.\frac{1}{2} + \cot^{-1}.\frac{1}{3}$

C. $\cot^{-1}1 + \cot^{-1}.\frac{1}{2} + \cot^{-1}.\frac{1}{3}$

D. $\cot^{-1}1 + \tan^{-1}3$

Answer: B

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69. The sum of series $\sec^{-1}\sqrt{2} + \frac{\sec^{-1}\left(\sqrt{10}\right)}{3} + \frac{\sec^{-1}\left(\sqrt{50}\right)}{7} + + \sec^{-1}\sqrt{\frac{\left(n^2+1\right)\left(n^2-2n+2\right)}{\left(n^2-n+1\right)^2}}$ is

(a)$\tan^{-1}n$ (b) n (c)$\tan^{-1}(n+1)$ (d) $\tan^{-1}(n-1)$

A. $\tan^{-1}1$

B. $\tan^{-1}n$

C. $\tan^{-1}(n+1)$

D. $\tan^{-1}(n-1)$

Answer: B

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70. If $\sin\theta = \frac{3}{5}$, then $\cos\theta$=?

A. $\tan 3\theta$

B. $3\tan\theta$

C. $(1/3)\tan\theta$

D. $3\cot\theta$

Answer: C

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71. The value $2\tan^{-1}\left[\sqrt{\frac{a-b}{a+b}}\frac{\tan\theta}{2}\right]$ is equal to (a)$\cos^{-1}\left(\frac{a\cos\theta+b}{a+b\cos\theta}\right)$ (b) $\cos^{-1}\left(\frac{a+b\cos\theta}{a\cos\theta+b}\right)$ $\cos^{-1}\left(\frac{a\cos\theta}{a+b\cos\theta}\right)$ (d) $\cos^{-1}\left(\frac{b\cos\theta}{a\cos\theta+b}\right)$

A. $\cos^{-1}\left(\frac{a\cos\theta+b}{a+b\cos\theta}\right)$

B. $\cos^{-1}\left(\frac{a+b\cos\theta}{a\cos\theta+b}\right)$

C. $\cos^{-1}\left(\frac{a\cos\theta}{a+b\cos\theta}\right)$

D. $\cos^{-1}\left(\frac{b\cos\theta}{a\cos\theta+b}\right)$

Answer: A

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72. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right)+\sin^{-1}\left(\frac{2b}{1+b^2}\right)=2\tan^{-1}x$, then x is equal to $[a, b, \in (0, 1)]$ $\frac{a-b}{1+ab}$ (b) $\frac{b}{1+ab}$ (c) $\frac{b}{1+ab}$ (d) $\frac{a+b}{1-ab}$

A. $\frac{a-b}{1+ab}$

B. $\frac{b}{1+ab}$

C. $\frac{b}{1-ab}$

D. $\frac{a+b}{1-ab}$

Answer: D

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73. If

$3\sin^{-1}\left(\frac{2x}{1+x^2}\right) - 4\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + 2\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \frac{\pi}{3}$, *where*$|x| < 1$,

then x is equal to (a)$\frac{1}{\sqrt{3}}$ (b) $-\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $-\frac{\sqrt{3}}{4}$

A. $\frac{1}{\sqrt{3}}$

B. $-\frac{1}{\sqrt{3}}$

C. $\sqrt{3}$

D. $-\frac{\sqrt{3}}{4}$

Answer: A

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74. If $x_1 = 2\tan^{-1}\left(\frac{1+x}{1-x}\right), x_2 = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, where $x \in (0, 1)$, then $x_1 + x_2$ is equal to 0 (b) 2π (c) π (d) none of these

A. 0

B. 2π

C. π

D. none of these

Answer: C

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75. If the equation $x^3 + bx^2 + cx + 1 = 0, (b < c)$, has only one real root α, then the value of $2\tan^{-1}(\operatorname{cosec}\alpha) + \tan^{-1}\left(2\sin\alpha\sec^2\alpha\right)$ is

A. $-\pi$

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

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

D. π

Answer: A

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76. The value of $\sin^{-1}\left[x\sqrt{1-x} - \sqrt{x}\sqrt{1-x^2}\right]$ is equal to $\sin^{-1}x + \sin^{-1}\sqrt{x}$ $\sin^{-1}x - \sin^{-1}\sqrt{x}$ $\sin^{-1}\sqrt{x} - \sin^{-1}x$ none of these

A. $\sin^{-1}x + \sin^{-1}\sqrt{x}$

B. $\sin^{-1}x - \sin^{-1}\sqrt{x}$

C. $\sin^{-1}\sqrt{x} - \sin^{-1}x$

D. none of these

Answer: B

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77. If $\cos^{-1}x - \frac{\cos^{-1}y}{2} = \alpha, then 4x^2 - 4xy\cos\alpha + y^2$ is equal to (a)4 (b) $2\sin^2\alpha$ (c) $-4\sin^2\alpha$ (d) $4\sin^2\alpha$

A. 4

B. $2\sin^2\alpha$

C. $-4\sin^2\alpha$

D. $4\sin^2\alpha$

Answer: D

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78. If

$\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi, then x^4 + y^2 + z^4 + 4x^2y^2z^2 = K\left(x^2y^2 + y^2z^2 + z^2x^2\right)$

where K is equal to 1 (b) 2 (c) 4 (d) none of these

A. 1

B. 2

C. 4

D. none of these

Answer: B

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79. If $f(x) = \sin^{-1}\left(\frac{\sqrt{3}}{2}x - \frac{1}{2}\sqrt{1 - x^2}\right), -\frac{1}{2} \le x \le 1, then f(x)$ is equal to

$\sin^{-1}\left(\frac{1}{2}\right) - \sin^{-1}(x)\ \sin^{-1}x - \frac{\pi}{6}\ \sin^{-1}x + \frac{\pi}{6}$ (d) none of these

A. $\sin^{-1}\left(\frac{1}{2}\right) - \sin^{-1}(x)$

B. $\sin^{-1}x - \frac{\pi}{6}$

C. $\sin^{-1}x + \frac{\pi}{6}$

D. none of these

Answer: B

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80. If $2^{2\pi/\sin(-1)x} - 2(a+2)^{\pi/\sin(-1)x} + 8a < 0$ for at least one real x, then $\frac{1}{8} \le a < 2$ (b) $a < 2$ $a \in R - \{2\}$ (d) $a \in \left[0, \frac{1}{8}\right] \cup (2, \infty)$

A. $\frac{1}{8} \le a \le 2$

B. $a \le 2$

C. $a \in R - \{2\}$

D. $a \in \left[0, \frac{1}{8}\right) \cup (2, \infty)$

Answer: D

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Exercise (Multiple)

1. If `alpha,beta(alpha

A. $\cos^{-1}\alpha$

B. $\sin^{-1}\beta$

C. $\operatorname{cosec}^{-1}\alpha$

D. Both $\cot^{-1}\alpha$ and $\cot^{-1}\beta$

Answer: B::C::D

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2. $2\tan^{-1}(-2)$ is equal to

A. $-\cos^{-1}\left(\frac{-3}{5}\right)$

B. $-\pi + \cos^{-1}.\frac{3}{5}$

C. $-\frac{\pi}{2} + \tan^{-1}\left(-\frac{3}{4}\right)$

D. $-\pi + \cot^{-1}\left(-\frac{3}{4}\right)$

Answer: A::B::C

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3. Which of the following is/are the value of $\cos\left[\frac{1}{2}\cos^{-1}\left(\cos\left(-\frac{14\pi}{5}\right)\right)\right]$?

$\cos\left(-\frac{7\pi}{5}\right)$ (b) $\sin\left(\frac{\pi}{10}\right)\cos\left(\frac{2\pi}{5}\right)$ (d) $-\cos\left(\frac{3\pi}{5}\right)$

A. $\cos\left(-\frac{7\pi}{5}\right)$

B. $\sin\left(\frac{\pi}{10}\right)$

C. $\cos\left(\frac{2\pi}{5}\right)$

D. $-\cos\left(\frac{3\pi}{5}\right)$

Answer: B::C::D

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4. Which one of the following is not a rational number ?

A. $\sin\left(\tan^{-1}3 + \tan^{-1}.\frac{1}{3}\right)$

B. $\cos\left(\frac{\pi}{2} - \sin^{-1}.\frac{3}{4}\right)$

C. $\log_2\left(\sin\left(\frac{1}{4}\sin^{-1}.\frac{\sqrt{63}}{8}\right)\right)$

D. $\tan\left(\frac{1}{2}\cos^{-1}.\frac{\sqrt{5}}{3}\right)$

Answer: A::B::C

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5. Which of the following quantities is/are positive? (a)$\cos\left(\tan^{-1}(tan4)\right)$ (b) $\sin\left(\cot^{-1}(\cot4)\right)$ $\tan\left(\cos^{-1}(\cos5)\right)$ (d) $\cot\left(\sin^{-1}(\sin4)\right)$

A. $\cos\left(\tan^{-1}(\tan 4)\right)$

B. $\sin\left(\cot^{-1}(\cot 4)\right)$

C. $\tan\left(\cos^{-1}(\cos 5)\right)$

D. $\cot\left(\sin^{-1}(\sin 4)\right)$

Answer: A::B::C

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6. If $x < 0$, *then* $\tan^{-1}x$ is equal to $-\pi + \frac{\cot^{-1}1}{x}$ (b) $\frac{\sin^{-1}x}{\sqrt{1+x^2}}$ $-\frac{\cos^{-1}1}{\sqrt{1+x^2}}$ (d) $-\text{cosec}^{-1}\frac{\sqrt{1+x^2}}{x}$

A. $-\pi + \cot^{-1}.\frac{1}{x}$

B. $\sin^{-1}.\frac{x}{\sqrt{1+x^2}}$

C. $-\cos^{-1}.\frac{1}{\sqrt{1+x^2}}$

D. $-\text{cosec}^{-1}.\frac{\sqrt{1+x^2}}{x}$

Answer: A::B::C

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7. If `-1

A. $\sec^{-1}.\frac{1}{x}$

B. $\pi - \sin^{-1}\sqrt{1-x^2}$

C. $\pi + \tan^{-1}.\frac{\sqrt{1-x^2}}{x}$

D. $\cot^{-1}.\frac{x}{\sqrt{1-x^2}}$

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

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8. If $\left(\sin^{-1}x + \sin^{-1}w\right)\left(\sin^{-1}y + \sin^{-1}z\right) = \pi^2,$ then $D = \left|x^{N_1}y^{N_3}z^{N_3}w^{N_4}\right|\left(N_1, N_2, N_3, N_4 \in N\right)$`

A. has a maximum value of 2

B. has a minimum value of 0

C. 16 different D are possible

D. has a minimum value of -2

Answer: A::C::D

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9. Indicate the relation which can hold in their respective domain for infinite values of x (a)$\tan\left|\tan^{-1}x\right| = |x|$ (b) $\cot\left|\cot^{-1}x\right| = |x|$ $\tan^{-1}|\tan x| = |x|$ (d) $\sin\left|\sin^{-1}x\right| = |x|$

A. $\tan\left|\tan^{-1}x\right| = |x|$

B. $\cot\left|\cot^{-1}x\right| = |x|$

C. $\tan^{-1}|\tan x| = |x|$

D. $\sin\left|\sin^{-1}x\right| = |x|$

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

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10. If $\cot^{-1}\left(\frac{n^2 - 10n + 21.6}{\pi}\right) > \frac{\pi}{6}$, where $xy < 0$ then the possible values of n is (a)3 (b) 2 (c) 4 (d) 8

A. 3

B. 2

C. 4

D. 8

Answer: A::C

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11. If $z = \sec^{-1}\left(x + \frac{1}{x}\right) + \sec^{-1}\left(y + \frac{1}{y}\right)$, where $xy < 0$, then the possible values of z is (a) $\frac{8\pi}{10}$ (b) $\frac{7\pi}{10}$ (c) $\frac{9\pi}{10}$ (d) $\frac{21\pi}{20}$

A. $\frac{8\pi}{10}$

B. $\frac{7\pi}{10}$

C. $\frac{9\pi}{10}$

D. $\frac{21\pi}{20}$

Answer: C::D

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12. The value of $k(k > 0)$ such that the length of the longest interval in which the function $f(x) = \sin^{-1}|\sin kx| + \cos^{-1}(\cos kx)$ is constant is $\frac{\pi}{4}$ is/ are 8 (b) 4 (c) 12 (d) 16

A. 8

B. 4

C. 12

D. 16

Answer: B

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13. Which of the following pairs of function/functions has same graph?

$y = \tan\left(\cos^{-1}x\right); y = \dfrac{\sqrt{1-x^2}}{x}$ $y = tan\left(\cot^{-1}x\right); y = \dfrac{1}{x}$

$y = \sin\left(\tan^{-1}x\right); y = \dfrac{x}{\sqrt{1-x^2}}$ $y = \cos\left(\tan^{-1}x\right); y = s \in \left(\cot^{-1}x\right)$

A. $y = \tan\left(\cos^{-1}x\right), y = \dfrac{\sqrt{1-x^2}}{x}$

B. $y = \tan\left(\cot^{-1}x\right), y = \dfrac{1}{x}$

C. $y = \sin\left(\tan^{-1}x\right), y = \dfrac{x}{\sqrt{1+x^2}}$

D. $y = \cos\left(\tan^{-1}x\right), y = \sin\left(\cot^{-1}x\right)$

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

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14. If $\sin^{-1}x - \cos^{-1}x = \frac{\pi}{6}$, then

A. $x = \frac{\pi}{8} + \sqrt{\frac{1}{2} - \frac{\pi^2}{64}}$

B. $y = \sqrt{\frac{1}{2} - \frac{\pi^2}{64}} - \frac{\pi}{12}$

C. $x = \frac{\pi}{12} + \sqrt{\frac{1}{2} - \frac{\pi^2}{64}}$

D. $y = \sqrt{\frac{1}{2} - \frac{\pi^2}{64}} - \frac{\pi}{8}$

Answer: A::D

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15. If $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$ and $0 < x, y, z < 1$ show that

$x^2 + y^2 + z^2 + 2xyz = 1$

A. $x^2 + y^2 + z^2 + 2xyz = 1$

B. $2\left(\sin^{-1}x + \sin^{-1}y + \sin^{-1}z\right) = \cos^{-1}x + \cos^{-1}y + \cos^{-1}z$

C. $xy + yz + zx = x + y + z - 1$

D. $\left(x + \frac{1}{x}\right) + \left(y + \frac{1}{y}\right) + \left(z + \frac{1}{z}\right) > 6$

Answer: A::B

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16. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}x$, then x is equal to $[a, b, \in (0, 1)]$ $\frac{a-b}{1+ab}$ (b) $\frac{b}{1+ab}$ (c) $\frac{b}{1+ab}$ (d) $\frac{a+b}{1-ab}$

A. $b = \frac{2a-3}{3a}$

B. $b = \frac{3a-2}{2a}$

C. $a = \frac{3}{2-3b}$

D. $a = \frac{2}{3-2b}$

Answer: A::C

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17. If $\tan^{-1}\left(x^2 + 3|x| - 4\right) + \cot^{-1}\left(4\pi + \sin^{-1}\sin 14\right) = \frac{\pi}{2}$, *then* the value of $\sin^{-1}\sin 2x$ is

A. $6 - 2\pi$

B. $2\pi - 6$

C. $\pi - 3$

D. $3 - \pi$

Answer: A::B

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18. If $2\tan^{-1}x + \frac{\sin^{-1}(2x)}{1 + x^2}$ is independent of x, then

A. $x > 1$

B. $x < -1$

C. $0 < x < 1$

D. $-1 < x < 0$

Answer: A::B

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19. If $\alpha = \tan^{-1}\left(\frac{4x - 4x^3}{1 - 6x^2 + x^2}\right), \beta = 2\sin^{-1}\left(\frac{2x}{1 + x^2}\right)$ and $\frac{\tan\pi}{8} = k,$ then

$\alpha + \beta = \pi f$ or $x \in \left[\frac{1, 1}{k}\right]$ $\alpha + \beta f$ or $x \in (-k, k)$ $\alpha + \beta = \pi f$ or $x \in \left[\frac{1, 1}{k}\right]$

$\alpha + \beta = 0f$ or $x \in [-k, k]$

A. $\alpha + \beta = \pi$ for $x \in \left[1, \frac{1}{k}\right)$

B. $\alpha = \beta$ for $x \in (-k, k)$

C. $\alpha + \beta = -\pi$ for $x \in \left[1, \frac{1}{k}\right)$

D. $\alpha + \beta = 0$ for $x \in (-k, k)$

Answer: A::B

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20. $2\tan\left(\tan^{-1}(x) + \tan^{-1}\left(x^3\right)\right)$, *where* $x \in R - \{-1, 1\}$, is equal to $\frac{2x}{1-x^2}$

$t\left(2\tan^{-1}x\right)\tan\left(\cot^{-1}(-x) - \cot^{-1}(x)\right)\tan\left(2\cot^{-1}x\right)$

A. $\frac{2x}{1-x^2}$

B. $\tan\left(2\tan^{-1}x\right)$

C. $\tan\left(\cot^{-1}(-x) - \cot^{-1}x\right)$

D. $\tan\left(2\cot^{-1}x\right)$

Answer: A::B::C

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21. Let $\alpha = som^{-1}\left(\frac{36}{85}\right), \beta = \cos^{-1}\left(\frac{4}{5}\right) and \gamma = \tan^{-1}\left(\frac{8}{15}\right)$ then

$\cot\alpha + \cot\beta + \cot\gamma = \cot\alpha\cot\beta\cot\gamma$ $\tan\alpha\tan\beta + \tan\beta\tan\gamma + \tan\alpha\tan\gamma = 1$

$\tan\alpha + \tan\beta + \tan\gamma = \tan\alpha\tan\beta\tan\gamma$ $\cot\alpha\cot\beta + \cot\beta\cot\gamma + \cot\alpha\cot\gamma = 1$

A. $\cot\alpha + \cot\beta + \cot\gamma = \cot\alpha\cot\beta\cot\gamma$

B. $\tan\alpha\tan\beta + \tan\beta\tan\gamma + \tan\alpha\tan\gamma = 1$

C. $\tan\alpha + \tan\beta + \tan\gamma = \tan\alpha\tan\beta\tan\gamma$

D. $\cot\alpha\cot\beta + \cot\beta\cot\gamma + \cot\alpha\cot\gamma = 1$

Answer: A::B

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22. If $S_n = \cot^{-1}(3) + \cot^{-1}(7) + \cot^{-1}(13) + \cot^{-1}(21) + \overset{..}{n}$ terms, then

$S_{10} = \frac{\tan^{-1}5}{6}$ $S_\infty = \frac{\pi}{4}$ (c) $S_6 = \frac{\sin^{-1}4}{5}$ (d) $S_{20} = \cot^{-1}1.1$

A. $S_{10} = \tan^{-1}.\frac{5}{6}$

B. $S_{\infty} = \frac{\pi}{4}$

C. $S_6 = \sin^{-1}.\frac{4}{5}$

D. $S_{20} = \cot^{-1}1.1$

Answer: A::B::D

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23. Equation $1 + x^2 + 2x\sin\left(\cos^{-1}y\right) = 0$ is satisfied by

A. exactly one value of x

B. exactly two values of x

C. exactly one value of y

D. exactly two values of y

Answer: A::C

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24. To the equation $2^{2\pi/\cos^{(-1)x}} - \left(a + \frac{1}{2}\right)2^{\pi/\cos^{(-1)x}} - a^2 = 0$ has only one real root, then $1 \leq a \leq 3$ (b) $a \geq 1$ $a \leq -3$ (d) $a \geq 3$

A. $1 \leq a \leq 3$

B. $a \geq 1$

C. $a \leq -3$

D. $a \geq 3$

Answer: B::C

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Exercise (Comprehension)

1. For $x, y, z, t \in R$, $\sin^{-1}x + \cos^{-1}y + \sec^{-1}z \geq t^2 - \sqrt{2\pi t} + 3\pi$

The value of $x + y + z$ is equal to

A. 1

B. 0

C. 2

D. -1

Answer: D

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2. For $x, y, z, t \in R$, $\sin^{-1}x + \cos^{-1}y + \sec^{-1}z \geq t^2 - \sqrt{2\pi t} + 3\pi$

The principal value of $\cos^{-1}\left(\cos 5t^2\right)$ is

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

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

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

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

Answer: B

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3. For $x, y, z, t \in R$, $\sin^{-1}x + \cos^{-1}y + \sec^{-1}z \geq t^2 - \sqrt{2\pi t} + 3\pi$

The value of $\cos^{-1}(\min\{x, y, z\})$ is

A. 0

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

C. π

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

Answer: C

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4. If $ax + b\sec\left(\tan^{-1}x\right) = c$ and $ay + b\sec\left(\tan^{-l}y\right) = c$, then $\frac{x + y}{1 - xy}$ is equal to

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

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

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

D. none of these

Answer: B

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5. $ax + b\left(\sec\left(\tan^{-1}x\right)\right) = c$ and $ay + b\left(\sec\left(\tan^{-1}y\right)\right) = c$

The value of $\frac{x + y}{1 - xy}$ is

A. $\frac{2ac}{a^2 - b^2}$

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

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

D. none of these

Answer: A

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6. If $ax + b\sec\left(\tan^{-1}x\right) = c$ and $ay + b\sec\left(\tan^{-l}y\right) = c$, then $\frac{x+y}{1-xy}$ is equal to

A. $\frac{2ab}{a^2 - c^2}$

B. $\frac{2ac}{a^2 - c^2}$

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

D. none of these

Answer: B

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7. Find the set of value of x for which the equation $\cos^{-1}x + \cos^{-1}\left(\frac{x}{2} + \frac{1}{2}\sqrt{3 - 3x^2}\right) = \frac{\pi}{3}$ holds goods

A. 1

B. 2

C. 0

D. -1

Answer: B

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8. Find the range of $f(x) = \left(\sin^{-1}x\right)^2 + 2\pi\cos^{-1}x + \pi^2$

A. cos. $\frac{\pi^2}{8}$

B. sin. $\frac{\pi^2}{4}$

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

D. none of these

Answer: D

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9. Find the range of $f(x) = \left(\sin^{-1}x\right)^2 + 2\pi\cos^{-1}x + \pi^2$

A. 1

B. -1

C. $\frac{1}{2}$

D. none of these

Answer: C

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10. Let $\cos^{-1}\left(4x^3 - 3x\right) = a + b\cos^{-1}x$

If $x \in \left[-1, -\frac{1}{2}\right)$, then the value of $a + b\pi$ is

A. 2π

B. 3π

C. π

D. -2π

Answer: C

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11. Let $\cos^{-1}\left(4x^3 - 3x\right) = a + b\cos^{-1}x$

If $x \in \left[-1, -\frac{1}{2}\right)$, then the value of $a + b\pi$ is

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

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

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

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

Answer: A

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12. Let $\cos^{-1}\left(4x^3 - 3x\right) = a + b\cos^{-1}x$

If $x \in \left(\frac{1}{2}, 1\right]$, then the value of $\lim_{y \to a} b\cos(y)$ is

A. $-1/3$

B. -3

C. $\frac{1}{3}$

D. 3

Answer: D

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13. solve $\sin^{-1}x \leq \cos^{-1}x$

A. 1

B. 2

C. 3

D. 4

Answer: C

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14. Let $a = \cos^{-1}\cos 20$, $b = \cos^{-1}\cos 30$ and $c = \sin^{-1}\sin(a + b)$ then

If $5\sec^{-1}x + 10\sin^{-1}y = 10(a + b + c)$ then the value of $\tan^{-1}x + \cos^{-1}(y - 1)$ is

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

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

C. π

D. 0

Answer: B

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15. Find the principal value of

$$\sin^{-1}\left(\frac{1}{2}\right)$$

A. $10 - 3\pi$

B. $10 - 2\pi$

C. $10 - \frac{5\pi}{2}$

D. $\frac{7\pi}{2} - 10$

Answer: B

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16. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2 x \cos x dx$ is

A. $\left(\frac{1}{\sqrt{2}}, 1\right]$

B. $\left(-\frac{1}{\sqrt{2}}, -1\right]$

C. $\left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$

D. $[-1, 1]$

Answer: A

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Exercise (Matrix)

1. Match the following List I to List II

List I	List II
a. $\sin^{-1}\frac{4}{5}+2\tan^{-1}\frac{1}{3}=$	p. $\pi/6$
b. $\sin^{-1}\frac{12}{13}+\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{63}{16}=$	q. $\pi/2$
c. If $A=\tan^{-1}\frac{x\sqrt{3}}{2\lambda-x}$ and $B=\tan^{-1}\left(\frac{2x-\lambda}{\lambda\sqrt{3}}\right)$ then the value of $A-B$ is,	r. $\pi/4$
d. $\tan^{-1}\frac{1}{7}+2\tan^{-1}\frac{1}{3}=$	s. π

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2. Find the area of the triangle formed by the points $A(0,-1), B(-2,6)$ and $C(-3,-5)$

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3. Match the following :

A	V_3O_5	*i.*	High density polyethylene
B	Ziegler – Natta	*ii.*	PAN
C	Peroxide	*iii.*	NH_3
D	Finely divided Fe	*iv.*	H_2SO_4

	A	B	C	D
(a)	**(iv)**	**(i)**	**(ii)**	**(iii)**
(b)	(i)	(ii)	(iv)	(iii)
(c)	(ii)	(iii)	(iv)	(i)
(d)	(iii)	(iv)	(ii)	(i)

A. $a\ b\ c\ d$ / $s\ r\ q\ p$

B. $a\ b\ c\ d$ / $q\ s\ r\ p$

C. $a\ b\ c\ d$ / $s\ r\ p\ q$

D. $a\ b\ c\ d$ / $r\ p\ s\ q$

Answer: B

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4. Match the following List I to List II

List I	List
a. If $(\sin^{-1}x)^2+(\sin^{-1}y)^2=\frac{\pi^2}{2}$, then x^3+y^3 can be	p. 0
b. $(\cos^{-1}x)^2+(\cos^{-1}y)^2=2\pi^2$, then x^5+y^5 can be	q. -2
c $(\sin^{-1}x)^2(\cos^{-1}y)^2=\frac{\pi^4}{4}$, then $x-y$ can be	r. 2
d. $\lvert\sin^{-1}x-\sin^{-1}y\rvert=\pi$, then $x-y$ can be	s. -1

A. $\begin{matrix} a & b & c & d \\ r & q & p & s \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ s & r & q & p \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ q & s & p & r \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ s & r & q & p \end{matrix}$

Answer: C

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5. Match the following List I to List II

List I	LIst II
a. Range of $f(x) = \sin^{-1} x + \cos^{-1} x + \cot^{-1} x$ is	**p.** $\left[0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right]$
b. Range of $f(x) = \cot^{-1} x + \tan^{-1} x + \text{cosec}^{-1} x$ is	**q.** $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$
c. Range of $f(x) = \cot^{-1} x + \tan^{-1} x + \cos^{-1} x$ is	**r.** $\{0, \pi\}$
d. Range of $f(x) = \sec^{-1} x + \text{cosec}^{-1} x + \sin^{-1} x$ is	**s.** $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$

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Exercise (Numerical)

1. The solution set of inequality $\left(\cot^{-1} x\right)\left(\tan^{-1} x\right) + \left(2 - \frac{\pi}{2}\right), \cot^{-1} x - 3\tan^{-1} x - 3\left(2 - \frac{\pi}{2}\right) > 0$ is (a, b), then the value of $\cot^{-1} a + \cot^{-1} b$ is____

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2. If $x = \sin^{-1}\left(a^6 + 1\right) + \cos^{-1}\left(a^4 + 1\right) - \tan^{-1}\left(a^2 + 1\right), a \in R,$ then the value of $\sec^2 x$ is_____

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3. If the roots of the equation $x^3 - 10x + 11 = 0$ are u, v, and w, then the value of $3\cos ec^2\left(\tan^{-1}u + \tan^{-1}v + \tan^{-1}w\right.$ is ___

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4. The number of values of x for which $\sin^{-1}\left(x^2 - \frac{x^4}{3} + \frac{x^6}{9}\right) + \cos^{-1}\left(x^4 - \left(\frac{x^8}{3} + \frac{x^{12}}{9}..\right)\right) = \frac{\pi}{2},$ where `0lt=|x|

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5. If the domain of the function $f(x) = \sqrt{3\cos^{-1}(4x) - \pi}$ is $[a, b]$, then the value of $(4a + 64b)$ is ___

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6. If `0

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7. If $\tan^{-1}\left(x + \frac{3}{x}\right) - \tan^{-1}\left(x - \frac{3}{x}\right) = \frac{\tan^{-1}6}{x}$, then the value of x^4 is____.

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8. If range of function $f(x) = \sin^{-1}x + 2\tan^{-1}x + x^2 + 4x + 1$ is $[p, q]$, then the value of $(p + q)$ is_____>

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9. The value of $\tan\left(\sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right)\right)\tan\left(\cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right)\right)$, $where x \in (0, 1)$, is equal to

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10. If the area enclosed by the curves $f(x) = \cos^{-1}(\cos x)$ and $g(x) = \sin^{-1}(\cos x)$ in $x \in [9\pi/4, 15\pi/4]$ is $a\pi^2/b$ (where a and b are coprime), then the value of b is ____

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11. Absolute value of sum of all integers in the domain of $f(x) = \cot^{-1}\sqrt{(x+3)x} + \cos^{-1}\sqrt{x^2+3x+1}$ is_____

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12. The least value of $\left(1+\sec^{-1}x\right)\left(1+cas^{-1}x\right)$ is _____

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13. Let $\cos^{-1}(x)+\cos^{-1}(2x)+\cos^{-1}(3x)be\pi$ If x satisfies the equation $ax^3+bx^2+cx-c_1=0$, then the value of $(b-a-c)$ is_____

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14. The number of integral values of x satisfying the equation $\tan^{-1}(3x)+\tan^{-1}(5x)=\tan^{-1}(7x)+\tan^{-1}(2x)$ is ___

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15. Number of solutions of equation $\sin\left(\cos^{-1}\left(\tan\left(\sec^{-1}x\right)\right)\right)=\sqrt{1+xis/are}$ __

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16. If the equation $\sin^{-1}\left(x^2+x+1\right)+\cos^{-1}(\lambda+1)=\frac{\pi}{2}$ has exactly two solutions for $\lambda \in [a, b]$, then the value of $a+b$ is

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17. $\sin\left\{2\left(\frac{\sin^{-1}\left(\sqrt{5}\right)}{3}-\frac{\cos^{-1}\left(\sqrt{5}\right)}{3}\right)\right\}$ is equal to $\frac{k\sqrt{5}}{81}$ then $k=$

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18. The number of solutions of $\cos\left(2\sin^{-1}\left(\cot\left(\tan^{-1}\left(\sec\left(6\operatorname{cosec}^{-1}x\right)\right)\right)\right)\right)+1=0$ where $x>0$ is

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JEE Main Previous Year

1. If x, y, z are in A.P. and $\tan^{-1}x, \tan^{-1}y$ and $\tan^{-1}z$ are alos in A.P. then

A. $x = y = z$

B. $2x = 3y = 6z$

C. $6x = 3y = 2z$

D. $6x = 4y = 3z$

Answer: A

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2. Let $\tan^{-1}y = \tan^{-1}x + \tan^{-1}\left(\frac{2x}{1 - x^2}\right)$, where $|x| < \frac{1}{\sqrt{3}}$. Then a value of y is : (1) $\frac{3x - x^3}{1 - 3x^2}$ (2) $\frac{3x + x^3}{1 - 3x^2}$ (3) $\frac{3x - x^3}{1 + 3x^2}$ (4) $\frac{3x + x^3}{1 + 3x^2}$

A. $\frac{3x - x^3}{1 - 3x^2}$

B. $\frac{3x + x^3}{1 - 3x^2}$

C. $\frac{3x - x^3}{1 + 3x^2}$

D. $\frac{3x + x^3}{1 + 3x^2}$

Answer: B

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JEE Advanced Previous Year

1. The value of $\sum_{i=1}^{13} \left(n^n + i^{n-1}\right)$ is

A. $\frac{23}{25}$

B. $\frac{25}{23}$

C. $\frac{23}{24}$

D. $\frac{24}{23}$

Answer: B

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2. about to only mathematics

A. $\cos\beta > 0$

B. $\sin\beta < 0$

C. $\cos(\alpha + \beta) > 0$

D. $\cos\alpha < 0$

Answer: B::C::D

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3. For any positive integer n, define $f_n : (0, \infty) \to R$ as $f_n(x) = \sum_{j=1}^{n} \tan^{-1}\left(\frac{1}{1 + (x + j)(x + j - 1)}\right)$ for all $x \in (0, \infty)$. Here, the inverse trigonometric function $\tan^{-1}x$ assumes values in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. Then, which of the following statement(s) is (are) TRUE? $\sum_{j=1}^{5} \tan^2\left(f_j(0)\right) = 55$ (b) $\sum_{j=1}^{10} (1 + fj'(0))\sec^2\left(f_j(0)\right) = 10$ (c) For any fixed positive integer n,

$(\lim)_{x \to \infty} \tan\left(f_n(x)\right) = \frac{1}{n}$ (d) For any fixed positive integer n, $(\lim)_{x \to \infty} \sec^2\left(f_n(x)\right) = 1$

A. $\sum_{j=1}^{5} \tan^2\left(f_j(0)\right) = 55$

B. $\sum_{j=1}^{10} \left(1 + f_j'(0)\right) \sec^2\left(f_j(0)\right) = 10$

C. For any fixed positive inetger n, $\lim_{x \to \infty} \tan\left(f_n(x)\right) = \frac{1}{n}$

D. For any fixed positive integer n, $\lim_{x \to \infty} \sec^2\left(f_n(x)\right) = 1$

Answer: A::B::D

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4. Match the following:

1.	C.S.A of a hollow cylinder	(a) $2\pi rh$
2.	C.S.A of right circular cylinder	(b) $2\pi r(h + r)$
3.	T.S.A of a cone	(c) $4\pi r^2$
4.	T.S.A of right circular cylinder	(d) $2\pi(R + r)h$
5.	S.A of sphere	(e) $\pi rl + \pi r^2$

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5. Match list I with list II and select the correct answer using the codes given below the lists:

List I	List II
A. Chorion	1. Nourishment
B. Allantois	2. Protection
C. Yolk sac	3. Fluid environment
D. Amnion	4. Excretion

Codes

	A	B	C	D
A.	*a*	*b*	*c*	*d*
	s	*r*	*p*	*q*
B.	*a*	*b*	*c*	*d*
	s	*r*	*q*	*p*
C.	*a*	*b*	*c*	*d*
	r	*s*	*q*	*p*
D.	*a*	*b*	*c*	*d*
	r	*s*	*p*	*q*

Answer: B

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6. Match the List-I and List-II using the correct code given below the list.

	List-I (Acids)	List-II (Basicity)
A.	HCl	1. 3
B.	H_2SO_4	2. 4
C.	$H_4P_2O_7$	3. 2
D.	H_3PO_4	4. 1

A. $a\ b\ c\ d$ / $s\ r\ p\ q$

B. $a\ b\ c\ d$ / $q\ s\ r\ p$

C. $a\ b\ c\ d$ / $s\ r\ p\ q$

D. $a\ b\ c\ d$ / $q\ s\ p\ r$

Answer: A

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7. Let $f: [0, 4\pi] \to [0, \pi]$ be defined by $f(x) = \cos^{-1}(\cos x)$ The number of points $x \in [0, 4\pi] satiy \in > he$ equation $f(x) = \frac{10 - x}{10}$ is____

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8. The number of real solution of the equation

$$\sin^{-1}\left(\sum_{i=1}^{\infty} x^{i+1} - x\sum_{i=1}^{\infty}\left(\frac{x}{2}\right)^i\right)$$

$$= \frac{\pi}{2} - \cos^{-1}\left(\sum_{i=1}^{\infty}\left(-\frac{x}{2}\right)^i - \sum_{i=1}^{\infty}(-x)^i\right)$$ lying in the interval $\left(-\frac{1}{2}, \frac{1}{2}\right)$ is _____.

(Here, the inverse trigonometric function $\sin^{-1}x$ and $\cos^{-1}x$ assume values in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and $[0, \pi]$ respectively)

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SINGLE CORRECT ANSWER TYPE

1. The values of x which satisfy $18\left(\sin^{-1}x\right)^2 - 9\pi\sin^{-1}x + \pi^2 < 0$ and $18\left(\tan^{-1}x\right)^2 - 9\pi\tan^{-1}x + \pi^2 < 0$ simultaneously are

A. $\left(\frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{2}\right)$

B. $\left(\frac{\sqrt{3}}{2}, 1\right)$

C. $\left(\frac{1}{3}, \frac{\sqrt{3}}{2}\right)$

D. $\left(\frac{1}{\sqrt{3}}, \sqrt{3}\right)$

Answer: A

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2. If $f(x) = \sin^{-1}\left(\text{cosec}\left(\sin^{-1}x\right)\right) + \cos^{-1}\left(\sec\left(\cos^{-1}x\right)\right)$, then f(x) takes

A. exactly two values

B. one value

C. undefined

D. infinite values

Answer: B

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3. The set of all real values of x satisfying $\sin^{-1}\sqrt{x} < \frac{\pi}{4}$, is

A. $\left(0, \frac{1}{2}\right)$

B. $\left[0, \frac{1}{2}\right)$

C. $\left(0, \frac{1}{2}\right]$

D. $\left[0, \frac{1}{2}\right]$

Answer: B

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4. The number of ordered triplets (x, y, z) satisfy the equation $\left(\sin^{-1}x\right)^2 = \frac{\pi^2}{4} + \left(\sec^{-1}y\right)^2 + \left(\tan^{-1}z\right)^2$

A. 2

B. 4

C. 6

D. 8

Answer: A

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5. The range of function $f(x) = \sin^{-1}\left(x - \sqrt{x}\right)$ is equal to

A. $\left[\sin^{-1}\frac{1}{4}, \frac{\pi}{2}\right]$

B. $\left[\sin^{-1}, \frac{\pi}{2}\right]$

C. $\left[-\sin^{-1}\frac{1}{4}, \frac{\pi}{2}\right]$

D. $\left[-\sin^{-1}\frac{1}{2}, \frac{\pi}{2}\right]$

Answer: C

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6. The number of solution of the equation $\left|\tan^{-1}|x|\right| = \sqrt{\left(x^2+1\right)^2 - 4x^2}$ is

A. 2

B. 3

C. 4

D. none of these

Answer: C

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7. The number of solutions of the equation $\sin^{-1}|x| = \left|\cos^{-1}x\right|$ are

A. 0

B. 1

C. 2

D. 3

Answer: B

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8. For $x \in (0, 1)$, let $\alpha = \sin^{-1}x, \beta = x, \gamma = \tan^{-1}x, \delta = \cot^{-1}x - \frac{\pi}{2}$. Which of the following is true ?

A. $\alpha > \beta > \gamma$

B. $\beta > \alpha > \gamma > \delta$

C. $\alpha > \beta > \gamma > \delta$

D. $\beta > \alpha > \delta > \gamma$

Answer: C

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9. If $x, y, z \in R$ are such that they satisfy $x + y + z = 1$ and $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \frac{\pi}{4}$, then the value of $\left|x^3 + y^3 + z^3 - 3\right|$ is

A. 1.5

B. 2

C. 2.5

D. 3

Answer: B

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10. The complete set of values of a for which the function $f(x) = \tan^{-1}\left(x^2 - 18x + a\right) > 0 \forall x \in R$ is

A. $(81, \infty)$

B. $[81, \infty)$

C. $(-\infty, 81)$

D. $(-\infty, 81]$

Answer: A

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11. The principal values of $\cos t^{-1}\left(-\frac{\sin(7\pi)}{6}\right)$ is

A. $\frac{5\pi}{3}$

B. $\frac{7\pi}{6}$

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

D. none of these

Answer: C

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12. The value of $\sec\left(\sin^{-1}\left(\sin\left(\frac{-50\pi}{9}\right)\right)+\cos^{-1}\left(\frac{\cos(31\pi)}{9}\right)\right)$

A. $\sec\frac{10\pi}{9}$

B. $\sec\frac{\pi}{9}$

C. 1

D. -1

Answer: D

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13. Maximum value of function $f(x) = \left(\sin^{-1}(\sin x)^2 - \sin^{-1}(\sin x)\right.$ is:

A. $\frac{\pi}{4}[\pi + 2]$

B. $\frac{\pi}{4}[\pi - 2]$

C. $\frac{\pi}{2}[\pi + 2]$

D. $\frac{\pi}{2}[\pi - 2]$

Answer: A

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14. The solution of $\sin^{-1}|\sin x| = \sqrt{\sin^{-1}|\sin x|}$ is

A. $n\pi \pm 1, n\pi, n \in Z$

B. $n\pi + 1, n\pi, n \in Z$

C. $n\pi - 1, n\pi, n \in Z$

D. $2n\pi + 1, n\pi, n \in Z$

Answer: A

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15. $\sin\left(\frac{1}{4}\sin^{-1}\left(\frac{\sqrt{63}}{8}\right)\right) is$

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. $\frac{1}{2\sqrt{2}}$

D. $\frac{1}{5}$

Answer: C

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16. Which of the following is not true ?

A. $\text{sincos}^{-1}\text{tancot}^{-1}x = \sqrt{1 - \frac{1}{x^2}}$

B. $\text{costan}^{-1}\text{cotsin}^{-1}x = x$

C. $\text{tancot}^{-1}\text{sincos}^{-1}x = \frac{1}{\sqrt{1 - x^2}}$

D. $\text{cotsin}^{-1}\text{costan}^{-1}x = \sqrt{1 - x^2}$

Answer: D

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17. The algebraic expression for $f(x) = \tan\left(\sin^{-1}\left(\cos\left(\tan^{-1}\frac{x}{2}\right)\right)\right)$ is

A. $\frac{2}{x}$

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

C. $\frac{1}{x}$

D. $\frac{2}{|x|}$

Answer: D

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18. The value of x satisfying the equation $\cos^{-1}3x + \sin^{-1}2x = \pi$ is

A. $x = \frac{1}{\sqrt{3}}$

B. $x = \frac{-1}{\sqrt{3}}$

C. $x = \frac{-1}{\sqrt{3}}$

D. none of these

Answer: D

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19. The minimum integral value of α for which the quadratic equation $\left(\cot^{-1}\alpha\right)x^2 - \left(\tan^{-1}\alpha\right)^{3/2}x + 2\left(\cot^{-1}\alpha\right)^2 = 0$ has both positive roots

A. 1

B. 2

C. 3

D. 4

Answer: B

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20. The number of roots of the equation $\sin^{-1}x - \frac{1}{\sin^{-1}x} = \cos^{-1}x - \frac{1}{\cos^{-1}x}$ is

A. 0

B. 1

C. 2

D. 3

Answer: C

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21. The solution set of the inequality $\tan^{-1}x + \sin^{-1}x \geq \frac{\pi}{2}$ is

A. $[-1, 1]$

B. $\left[\sqrt{\frac{\sqrt{5}-1}{4}}, 1\right]$

C. $\left[\sqrt{\frac{\sqrt{5}-1}{2}}, 1\right]$

D. $\left[\frac{\sqrt{5}-1}{2}, 1\right]$

Answer: C

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22. The sum of all possible values of x satisfying the equation $\sin^{-1}\left(3x - 4x^3\right) + \cos^{-1}\left(4x^3 - 3x\right) = \frac{\pi}{2}$ is

A. -2

B. -1

C. 1

D. 0

Answer: D

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23. If maximum and minimum values of $\left|\sin^{-1}x\right| + \left|\cos^{-1}x\right|$ are M and m, then M+m is

A. $\pi/2$

B. π

C. 2π

D. 3π

Answer: C

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24. If the function $f(x) = \sin^{-1}x + \cos^{-1}x$ and g(x) are identical, then g(x) can be equal to

A. $\sin^{-1}|x| + \left|\cos^{-1}x\right|$

B. $\tan^{-1}x + \cot^{-1}x$

C. $\left|\sin^{-1}x\right| + \cos^{-1}|x|$

D. $\left(\sqrt{\sin^{-1}x}\right)^2 + \left(\sqrt{\cos^{-1}x}\right)^2$

Answer: C

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25. The value of x satisfying $\sin^{-1}\left(\sqrt{\frac{3x-1}{25}}\right)+\sin^{-1}\left(\sqrt{\frac{3x+1}{25}}\right)=\frac{\pi}{2}$ lies in the interval

A. (1,2)

B. (2,3)

C. (3,4)

D. (4,5)

Answer: D

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26. The set of values of k for which the equation $\sin^{-1}x+\cos^{-1}x+\pi(|x|-2)=k\pi$ possesses real solution is [a,b] then the value of a + b is

A. 0

B. -2

C. -1

D. 2

Answer: B

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27. The soluation set of inequality $\left(\sin x + \cos^{-1} x\right) - \left(\cos x - \sin^{-1} x\right) \geq \frac{\pi}{2}$, is equal to

A. $\left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$

B. $\bigcup_{n \in I}\left[2n\pi + \frac{\pi}{4}, 2n\pi + \frac{5\pi}{4}\right]$

C. $\left[\frac{\pi}{4}, 1\right]$

D. $\left[-1, \frac{-\pi}{4}\right] \cup \left[\frac{\pi}{4}, 1\right]$

Answer: C

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28. The number of integral values in the range of the function $f(x) = \sin^{-1}x - \cot^{-1}x + x^2 + 2x + 6$ is

A. 10

B. 11

C. 12

D. 8

Answer: D

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

A. $a > x > b$

B. $a < x < b$

C. $a = x = b$

D. $a > b$ and x takes any value

Answer: A::B

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30. The value(s) of x satisfying $\tan^{-1}(x+3) - \tan^{-1}(x-3) = \sin^{-1}\left(\frac{3}{5}\right)$ may be

A. -2

B. -1

C. 2

D. No solution

Answer: D

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31. If x and y are positive integer satisfying $\tan^{-1}\left(\frac{1}{x}\right) + \tan^{-1}\left(\frac{1}{y}\right) = \frac{1}{7}$, then the number of ordered pairs of (x,y) is

A. 3

B. 4

C. 5

D. 6

Answer: D

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32. Solve $\sin^{-1}(1 - x) - 2s \in^{-1} x = \frac{\pi}{2}$

A. $0, \frac{1}{2}$

B. $1, \frac{1}{2}$

C. 0

D. $\frac{1}{2}$

Answer: C

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33. If $\cos^{-1}\left(\frac{x^2-1}{x^2+1}\right)+\tan^{-1}\left(\frac{2x}{x^2-1}\right)=\frac{2\pi}{3}$, then x equal to (A) $\sqrt{3}$ (B) $2+\sqrt{3}$ (C) $2-\sqrt{3}$ (D) $-\sqrt{3}$

A. 2

B. $\sqrt{3}$

C. 4

D. 3

Answer: B

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34. The solution of $\sin^{-1}x - \sin^{-1}2x = \pm\frac{\pi}{3}$ is

A. $\pm\frac{1}{3}$

B. $\pm\frac{1}{4}$

C. $\pm\frac{\sqrt{3}}{2}$

D. $\pm\frac{1}{2}$

Answer: D

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35. If $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + \sin^{-1}\left(\frac{2x}{1+x^2}\right) = p$ for all $x \in [-1, 0]$, then p is equal to

A. $\frac{-\pi}{2}$

B. 0

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

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

Answer: B

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36. Let $f(x) = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $g(x) = \cos^{-1}\left(\frac{x^2-1}{x^2+1}\right)$. Then tha value of f(10)-g(100) is equal to

A. $\pi - 2\left(\tan^{-1}(10) + \tan^{-1}(100)\right)$

B. 0

C. $2\left(\tan^{-1}(100) - \tan^{-1}(10)\right)$

D. $2\left(\tan^{-1}(10) - \tan^{-1}(100)\right)$

Answer: C

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37. Solve $\tan^{-1}x + \cot^{-1}(-|x|) = 2\tan^{-1}6x$

A. 4

B. 3

C. 2

D. 1

Answer: C

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38. $\frac{\sin^{-1}(3x)}{5} + \frac{\sin^{-1}(4x)}{5} = \sin^{-1}x$, then roots of the equation are- a.0 b. 1 c.-1 d. -2

A. 0

B. 1

C. 2

D. 3

Answer: D

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39. If $x \in \left[-1, \frac{-1}{\sqrt{2}}\right]$, then the inverse of the function $f(x) = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ is given by

A. $-\cos.\frac{y}{2}$

B. $\cos.\frac{y}{2}$

C. $-2\cos y$

D. $-2\cos y$

Answer: A

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40. The expression $\sum_{n=1}^{\infty} \cot^{-1}\left(n^2 - 3n + 3\right)$ simplifies to

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

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

C. $\frac{3\pi}{4}$

D. π

Answer: C

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41. The value of sum $\sum_{n=1}^{\infty} \cot^{-1}\left(\frac{\left(n^2 + 2n\right)\left(n^2 + 2n + 1\right) + 1}{2n + 2}\right)$ is equal to

A. $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$

B. $\sec^{-1}\left(\frac{\sqrt{5}}{3}\right)$

C. $\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$

D. $\cot^{-1}(1)$

Answer: C

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42. The number of solution of the equation $2\sin^{-1}\left(\frac{2x}{1+x^2}\right) - \pi x^3 = 0$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: D

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Comprehension Type

1. $f(x) = \sin^{-1}x + \left|\sin^{-1}x\right| + \sin^{-1}|x|$ no. of solution of equation f(x)=x is

A. 1

B. 0

C. 2

D. 3

Answer: A

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2. Let $f(x) = \sin^{-1}x + \left|\sin^{-1}x\right| + \sin^{-1}|x|$ The range of f(x) is

A. $\left[0, \frac{\pi}{2}\right]$

B. $\left[0, \frac{3\pi}{2}\right]$

C. $\left[0, \frac{\pi}{4}\right]$

D. $[0, \pi]$

Answer: B

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3. Let $f(x) = \sin^{-1}x + \left|\sin^{-1}x\right| + \sin^{-1}|x|$ If the equation f(x) = k has two solutions, then true set of values of k is

A. $k \in \left(0, \frac{\pi}{2}\right)$

B. $k \in \left[0, \frac{\pi}{2}\right]$

C. $k \in \left(0, \frac{\pi}{2}\right]$

D. $k \in \left[0, \frac{\pi}{2}\right)$

Answer: C

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Multiple Correct Answers Type

1. Let $f(x) = \cos^{-1}\left(\frac{1 - \frac{\tan^2(x)}{2}}{1 + \frac{\tan^2(x)}{2}}\right)$. Then which of the following statement is/are true ?

A. Ranges of f(x) is $[0, \pi)$

B. $f(x) = \pi$ has infinite roots

C. y = f(x) is identical with $y = \cos^{-1}(\cos x)$

D. y = f(x) has period 2π

Answer: A::D

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2. If $f(x) = \sin^{-1}(\sin x)$, $g(x) = \cos^{-1}(\cos x)$ and $h(x) = \cot^{-1}(\cot x)$, then which of the following is/are correct ?

A. $f(x) = g(x) = h(x)\ \forall x \in \left(\frac{\pi}{4}, \frac{\pi}{3}\right)$

B. $f(x) < g(x) < h(x)\ \forall x \in \left(\frac{\pi}{2}, \pi\right)$

C. $h(x) > g(x) > f(x)\ \forall x \in \left(\frac{3\pi}{2}, 2\pi\right)$

D. $f(x) > g(x)$ has no real solution

Answer: A::C::D

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3. If $\sin^{-1}\left(\frac{\sqrt{x}}{2}\right) + \sin^{-1}\left(\sqrt{1 - \frac{x}{4}}\right) + \tan^{-1} y = \frac{2\pi}{3}$, then

A. maximum value of $x^2 + y^2$ is $\frac{49}{3}$

B. maximum value of $x^2 + y^2$ is 4

C. minimum value of $x^2 + y^2$ is $\frac{1}{3}$

D. minimum value of $x^2 + y^2$ is 3

Answer: A::C::D

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4. Solve the following equations: $\sin\left[2\cos^{-1}\{\cot(2\tan^{-1}x\}\right] = 0$

A. ± 1

B. $1 \pm \sqrt{2}$

C. $-1 \pm \sqrt{2}$

D. $\pm\sqrt{2}$

Answer: A::B::C

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5. Let x_1, x_2, x_3, x_4 be four non zero numbers satisfying the equation $\tan^{-1}\left(\frac{a}{x}\right) + \tan^{-1}\left(\frac{b}{x}\right) + \tan^{-1}\left(\frac{c}{x}\right) + \tan^{-1}\left(\frac{d}{x}\right) = \frac{\pi}{2}$ then which ofthe following relation(s) hold good?

A. $x_1 + x_2 + x_3 + x_4 = a + b + c + d$

B. $\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \frac{1}{x_4} = 0$

C. $x_1 x_2 x_3 x_4 = abcd$

D. $\left(x_2 + x_3 + x_4\right)\left(x_3 + x_4 + x_1\right)\left(x_1 + x_2 + x_3\right) = abcd$

Answer: B::C::D

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6. Which of the following is/are true ?

A. $\tan^{-1}\frac{1}{3} = \frac{1}{2}\sin^{-1}\frac{3}{5}$

B. $\tan^{-1}\frac{1}{3} = \frac{\pi}{4} - \cot^{-1}2$

C. $\tan^{-1}\frac{1}{3} = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}\frac{4}{5}$

D. $\tan^{-1}\frac{1}{3} = \frac{\pi}{2} - \cot^{-1}3$

Answer: A::B::C

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Question Bank

1. If α and β are the two zeroes of the equation $3\cos^{-1}\left(x^2 - 5x - \frac{11}{2}\right) = \pi$, then $\left(\alpha^3 + \beta^3\right)$ equals

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2. If $\log_2 x > 0$ then the absolute value of $\frac{\log_1}{\pi}\left(\frac{\sin^{-1}(2x)}{1+x^2} + 2\tan^{-1}x\right)$ is equal to

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3. Find the value of $\sin^{-1}(\sin 5) + \cos^{-1}(\cos 10) + \tan^{-1}\{\tan(-6)\} + \cot^{-1}\{\cot(-10)\}$.

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4. Total number of ordered pairs (x, y) satisfying Iyl=cosxandy=sin−1(sinx) where |x|≤3π is equal to

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5. If the equation $\sin^{-1}\left(x^2 + x + 1\right) + \cos^{-1}(\lambda + 1) = \frac{\pi}{2}$ has exactly two solutions for $\lambda \in [a, b]$, then the value of $a + b$ is

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6. Number of values of x satisfying the equation $\cos^{-1}\left(x^2 - .5x + 6\right) = 2\cot^{-1}(1)$, is equal to

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7. Prove that , tan^(-1)(cotx)+cot^(-1) (tan x) = pi-2x

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