MATHS

BOOKS - CENGAGE MATHS (HINGLISH)

INVERSE TRIGONOMETRIC FUNCTIONS

Examples

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

A. $x \in \left[\frac{1}{\sqrt{2}}, 1\right]$

B. $x \in [0, 1]$

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

D. $x \in \left[\frac{1}{\sqrt{5}}, 1\right]$

Answer: A

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

A. $\left[\frac{\pi}{2}, \pi\right)$

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

C. $\left[\frac{\pi}{6}, \pi\right)$

D. $\left[\frac{\pi}{8}, \pi\right)$

Answer: B

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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 $\sqrt{\left|s\in^{-1}\left|\cos\right|\right|+\left|\cos^{1}|\sin x|\right|}=\sin^{-1}|\cos x|-\cos^{-1}|\sin x|,\ \frac{-\pi}{2}\le x\le\frac{\pi}{2}$.

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6. If`p > q >0a n dp r<-1“ ”

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7. If `0

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

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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 $\sin^{-1}x > -1$

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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. Sove $\left[\cot^{-1}x\right] + \left[\cos^{-1}x\right] = 0$, where $[.]$ denotes the greatest integer function

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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 value of k

A. $(-1,1)$

B. (- 2, 2)

C. (- 3, 3)

D. (- 4, 4)

Answer: B

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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

A. ± 1

B. 0

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

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

Answer: D

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

A. -1

B. 0

C. 1

D. None of these

Answer: B

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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 $\sin^{-1}\left[\sin\left(\frac{2x^2+4}{1+x^2}\right)\right] < \pi - 3$

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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 the principal values of the following

(i) $\tan^{-1}\left(\tan.\ \frac{2\pi}{3}\right)$ (ii) $\tan^{-1}(\tan(-6))$

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

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

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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 $\sin^{-1}x = \pi/5$, for some $x \in (-1, 1)$, 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 $\left(\sec^{-1}x\right)^2+\left(\operatorname{cosec}^{-1}x\right)^2$

A. π^2

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

C. $\frac{\pi^2}{4}$

D. $\frac{\pi^2}{6}$

Answer: C

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

A. $\left[\frac{\pi^2}{4}, \frac{9\pi^2}{4}\right]$

B. $\left[\frac{3\pi^2}{4}, \frac{11\pi^2}{4}\right]$

C. $\left[\frac{5\pi^2}{4}, \frac{13\pi^2}{4}\right]$

D. $\left[\frac{7\pi^2}{4}, \frac{15\pi^2}{4}\right]$

Answer: C

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

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

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

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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. For which values of x, function $f(x) = \sin^{-1}x + \sin^{-1}.\frac{1}{x} + \cos^{-1}x + \cos^{-1}.\frac{1}{x}$ is defined? Also, find the range

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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 angles

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

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69. Prove that: `tan^(-1)(1/2tan2A)+tan^(-1)(cota)+tan^(-1)(cot^3A)={0,ifpi/4

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

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71. Simplify `[(3sin2alpha)/(5+3cos2alpha)]+tan^(-1)[(tanalpha)/4],w h e r e-pi/2

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

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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

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

A. π

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

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

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

Answer: A

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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 A.P. with common difference d, then prove that

$$\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{d}{1+a_{n-1}a_n}\right)\right]=\frac{(n-1)d}{1+a_1a_n}$$

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

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

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

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

D. $\frac{\pi}{12}$

Answer: A

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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 $4\tan^{-1}.\frac{1}{5} - \tan^{-1}.\frac{1}{70} + \tan^{-1}.\frac{1}{99}$

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

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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 ?

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

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89. 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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90. 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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91. Solve $\sin^{-1}x\cos^{-1}x = \sin^{-1}(3x - 2)$

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92. If $A = 2\tan^{-1}\left(2\sqrt{2} - 1\right)$ and $B = 3\sin^{-1}\left(\frac{1}{3}\right) + \sin^{-1}\left(\frac{3}{5}\right)$, then which is greater ?

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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 value of x

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

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

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Exercise 7.1

1. Find the principal value of ltrbgt (a) $\operatorname{cosec}^{-1}(-1)$ (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. Solver $\sin^{-1}x > \tan^{-1}x$

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

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

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Exercise 7.2

1. Find the following values :

(a) $\tan^{1}\tan.\frac{13\pi}{5}$ (b) $\sec^{-1}\sec.\frac{13\pi}{3}$

(c) $\sin^{-1}\sin.\frac{33\pi}{5}$ (d) $\sin^{-1}(\sin 8)$

(e) $\tan^{-1}(\tan 10)$ (f) $\sec^{-1}(\sec 9)$

(g) $\cot^{-1}(\cot 6)$ (h) $\operatorname{cosec}^{-1}(\operatorname{cosec} 7)$

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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 values of $x \in [0, 2\pi]$ for which function $f(x) = \tan^{-1}(\tan x)$ and $g(x) = \cos^{-1}(\cos x)$ are identical

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

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4. Prove that $\sin\cot^{-1}\tan\cos^{-1}x = \sin\text{cosec}^{-1}\cot\tan^{-1}x = x$, where $x \in [0, 1]$

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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. Prove that: `tan^(-1){(sqrt(1+x)-sqrt(1-x))/(sqrt(1+x)+sqrt(1-x))}=pi/4-1/2\ cos^(-1)x ,\ \ 0

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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 $\tan^{-1}\left(-\tan.\frac{13\pi}{8}\right) + \cot^{-1}\left(-\cot\left(\frac{9\pi}{8}\right)\right)$

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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 $\sin^{-1}x + \sin^{-1} = \frac{2\pi}{3}$, 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. Prove that $\sin^{-1}\cos\left(\sin^{-1}x\right) + \cos^{-1}x\Big) = \frac{\pi}{2}, |x| \leq 1$

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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 $\sec^{-1}x > \cos ec^{-1}x$

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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. If equation $\sin^{-1}\left(4\sin^{20\theta+\sin\theta} + \cos^{-1}(6\sin\theta - 1)\right) = \frac{\pi}{2}$ has 10 solution for $\theta \in [0, n\pi]$, then find the minimum value of n

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

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5. The number of real values of x satisfying $\tan^{-1}\left(\frac{x}{1-x^2}\right) + \tan^{-1}\left(\frac{1}{x^3}\right)$ is

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

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7. Write the following function in the simplest form:

$\tan^{-1}\left(\frac{3a^2x - x^3}{a^3 - 3ax^2}\right), a > 0; \frac{-a}{\sqrt{3}} \leq x \leq \frac{a}{\sqrt{3}}$

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8. Solve the equation $2\tan^{-1}(\cos x) = \tan^{-1}(2\cos ecx)$

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

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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 $\sin^{-1}\left\{\cot\left(\sin^{-1}\left(\sqrt{\frac{2-\sqrt{3}}{4}}+\cos^{-1}\left(\frac{\sqrt{12}}{4}\right)+\sec^{-1}\sqrt{2}\right)\right)\right\}$ is

A. 0

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

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

D. none of these

Answer: A

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3. If $\cot^{-1}\left(\frac{n}{\pi}\right) > \frac{\pi}{6}, n \in N$, then the maximum value of n is :

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

A. 5

B. 13

C. 15

D. 6

Answer: C

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6. The maximum value of $f(x) = \tan^{-1}\left(\frac{\left(\sqrt{12}-2\right)x^2}{x^2+2x^2+3}\right)$ is

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

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

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 $\sqrt{1+\cos 2x}=\sqrt{2}\sin^{-1}(\sin x),\ -\pi\le x\le\pi$, is

A. 0

B. 1

C. 2

D. infinite

Answer: C

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11. The equation $3\cos^{-1}x - \pi x - \frac{\pi}{2} = 0$has

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

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. Equation $\left[\cot^{-1}x\right] + 2\left[\tan^{-1}x\right] = 0$, where $[.]$ denotes the greatest integer function, is satisfied by

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

A. 1

B. 2

C. 3

D. 4

Answer: B

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17. 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

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 number of the solutions 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

Answer: D

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19. complete solution set of $\tan^{-1}\left(\sin^{-1}x\right)>1$ 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

Answer: A

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20. The trigonometric equation $\sin^{-1}x = 2\sin^{-1}a$ has a solution for all real values (b) $|a| < \frac{1}{a}$ $|a| \leq \frac{1}{\sqrt{2}}$ (d) $\frac{1}{2} < |a| < \frac{1}{\sqrt{2}}$

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 $\left|\cos^{-1}\left(\frac{1 - x^2}{1 + x^2}\right)\right| < \frac{\pi}{3}$, then

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 $\frac{\pi}{2}$ (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 $2\cos^{-1}x = \cot^{-1}\left(\frac{2x^2 - 1}{2x\sqrt{1 - x^2}}\right)$? (0, 1) (*b*) (-1, 1) -{0} (- 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 the solution set of the equat where $x \in (0, 1)$, is equal to

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* $\frac{\pi}{10}$ (b) $\frac{\pi}{5}$ (c) $\frac{2\pi}{5}$ (d) $\frac{4\pi}{5}$

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

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 $\frac{\alpha^3}{2}\text{cosec}^2\left(\frac{1}{2}\frac{\tan^{-1}\alpha}{\beta}\right)+\frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\left(\frac{\beta}{\alpha}\right)\right)isequa<o$

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

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

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 : $2\tan^{-1}\left(\text{cosec}\tan^{-1}x - \tan\cot^{-1}x\right) = \tan^{-1}x$

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 the value of $a\sqrt{\left(1 - a^2\right)} + b\sqrt{\left(1 - b^2\right)} + \sqrt{\left(1 - c^2\right)}$ will be $2abc$ (b) abc (c) $\frac{1}{2}abc$ (d) $\frac{1}{3}abc$

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 $a\sin^{-1}x + b\cos^{-1}$ equal to

A. 0

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

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

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

Answer: D

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40. The solution of the inequality $\log_2 \sin^{-1} x > \log_{1/2} \cos^{-1} x$ is

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 `0cos^(-1)(sintheta)i st r u ew h e n(pi/4,pi)(b)(pi,(3pi)/2)(pi/4,(3pi)/4)(d)((3pi)/4,2pi)`

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 $\left|\sin^{-1}x\right| + \left|\cos^{-1}x\right| = \frac{\pi}{2}$, then $x \in$

A. R

B. $[-1, 1]$

C. $[0, 1]$

D. ϕ

Answer: C

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43. If $\left(\sin^{-1}x\right)^2 - \left(\cos^{-1}x\right)^2 = a\pi^2$ then find the range of a

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

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

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 $x \in R$ (b) $x > 0$ (c) $x \in [-1, 1]$ (d) $x \in [0, 1]$

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. If $\sin^{-1}\left(\frac{5}{x}\right)+\sin^{-1}\left(\frac{12}{x}\right)=\frac{\pi}{2}$, then x is equal to $\frac{7}{13}$ (b) $\frac{4}{3}$ (c) 13 (d) $\frac{13}{7}$

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 $\tan^{-1}\left(\sin^2\theta - 2\sin\theta + 3\right) + \cot^{-1}\left(5^{\sec \wedge (2y)} + 1\right) = \frac{\pi}{2}$, then value of $\cos^2\theta - \sin\theta$ is equal to

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 $\sin^{-1}\cos\left(\frac{2x^2+10|x|+4}{x^2+5|x|+3}\right)=\cot\left(\cot^{-1}\left(\frac{2-18|x|}{9|x|}\right)\right)+\frac{x}{2}is$ 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 values of a for which $a - \cot^{-1}3x = 2\tan^{-1}3x + \cos^{-1}x\sqrt{3} + \sin^{-1}x\sqrt{3}$ may have solution, is

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 $\tan\left(\frac{\pi}{4} - \frac{u}{2}\right)$ is equal to (a) $\sqrt{\tan\alpha}$ (b) $\sqrt{\cos\alpha}$ (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 $[-1, 1] - \{0\}$ (b) $(0, 1) \cup \{-1\}$ $(-1, 0) \cup \{1\}$ (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 $\cos^{-1}\sqrt{\frac{2}{3}} - \cos^{-1}\left(\frac{\sqrt{6}+1}{2\sqrt{3}}\right)$ is equal to:

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

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

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

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

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 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 solution of the equation $\tan^{-1}(1+x)+\tan^{-1}(1-x)=\frac{\pi}{2}$ is

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 $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}$ (b) xyz $xy+yz+zx$ (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 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* 2θ (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 equal to

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

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

C. $\tan\alpha$

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

Answer: A

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66. $\sum_{r=1}^{n} \sin^{-1}\left(\frac{\sqrt{r}-\sqrt{r-1}}{\sqrt{r}(r+1)}\right)$ 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. $\tan^{-1}\left(\sqrt{n+1}\right)$

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

Answer: A

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68. 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

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

$\tan^{-1}1$ (b) $n\tan^{-1}(n+1)$ (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 $\frac{1}{2}\sin^{-1}\left[\frac{3\sin 2\theta}{5+4\cos 2\theta}\right] = \tan^{-1}x$, then $x =$

A. $\tan 3\theta$

B. $3\tan\theta$

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

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

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 $3\sin^{-1}\left(\frac{2x}{1+x^2}\right) - 4\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + 2\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \frac{\pi}{3}$, then x is equal to

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

A. 0

B. 2π

C. π

D. none of these

Answer: C

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75. If the equation `x^3+b x^2+c x+1=0,(b

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 $\cos^{-1}x - \cos^{-1}\left(\frac{y}{2}\right) = \alpha$ then $4x^2 - 4xy\cos\alpha + y^2 =$

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

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

B. $a \leq 2$

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 $\alpha, \beta(\alpha < \beta)$ are the roots of the equation $6x^2 + 11x + 3 = 0$, then which of the following are real ?

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

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

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

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 $\cos\left[\frac{1}{2}\cos^{-1}\left(\cos\left(-\frac{14\pi}{5}\right)\right)\right]$?

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

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 $-1 < x < 0$, then $\cos^{-1}x$ is equal to

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 $D = \left|x^{N_1}y^{N_3}z^{N_3}w^{N_4}\right|\left(N_1, N_2, N_3, N_4 \in N\right)$ has a maximum value of 2 has a maximum value of 0 16 different D are possible has a minimum value of -2

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 $\tan\left|\tan^{-1}x\right| = |x|$ (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 z is (are) 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 value of z is (are)

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

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 $\sin^{-1}x + \sin^{-1}y = \dfrac{\pi}{2}$ and $\sin 2x = \cos 2y$, 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 $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = 3\pi$, then $xy + yz + zx$ is equal to

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 $\sin^{-1}\left(a - \frac{a^2}{3} + \frac{a^3}{9} - \ldots\right) + \cos^{-1}\left(1 + b + b^2 + \ldots\right) = \frac{\pi}{2}$ then find a and b

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 $\tan^{-1}\left(x^2 + 3|x| - 4\right) + \cot^{-1}\left(4\pi + \sin^{-1}s \in 14\right) = \frac{\pi}{2}$, *then* the value of $\sin^{-1}2x$ is $6 - 2\pi$ (b) $2\pi - 6$ $\pi - 3$ (d) $3 - \pi$

A. $6 - 2\pi$

B. $2\pi - 6$

C. $\pi - 3$

D. $3 - \pi$

Answer: A::B

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18. If $2\tan^{-1}x + \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ 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 $x \in \left[\frac{1, 1}{k}\right]$

$\alpha + \beta = 0 f$ 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 $S_n = \cot^{-1}(3) + \cot^{-1}(7) + \cot^{-1}(13) + \cot^{-1}(21) + \ldots\ldots, n$ terms, then

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 exactly one value of x exactly two value of x exactly one value of y exactly two value of y

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. 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. $\frac{2ac}{a^2 - b^2}$

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. Consider the system of equations $\cos^{-1}x + \left(\sin^{-1}y\right)^2 = \frac{p\pi^2}{4}$ and $\left(\cos^{-1}x\right)\left(\sin^{-1}y\right)^2 = \frac{\pi^4}{16}, p \in Z$

The value of p for which system has a solution is

A. 1

B. 2

C. 0

D. -1

Answer: B

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8. If $n \in N$ and the set of equations, $\left(\sin^{-1}y\right)^2 + \left(\cos^{-1}x\right) = \frac{n\pi^2}{4}$ and $\left(\sin^{-1}y\right)^2 - \left(\cos^{-1}x\right) = \frac{\pi^2}{16}$ is consistent,then n can be equal to-

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. If $n \in N$ and the set of equations, $\left(\sin^{-1}y\right)^2 + \left(\cos^{-1}x\right) = \frac{n\pi^2}{4}$ and $\left(\sin^{-1}y\right)^2 - \left(\cos^{-1}x\right) = \frac{\pi^2}{16}$ is consistent,then n can be equal to-

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 $x \in \left[-\frac{1}{2}, -1\right]$, then $a + b\pi =$

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 $\lim_{y \to a} bcos(y)$ is

A. $-1/3$

B. -3

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

D. 3

Answer: D

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13. Let $a = \cos^{-1}\cos 20$, $b = \cos^{-1}\cos 30$ and $c = \sin^{-1}\sin(a+b)$ then

The largest integer x for which $\sin^{-1}(\sin x) \geq |x - (a+b+c)|$ is

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. Consider the function $f(x) = \sin^{-1}x$, having principal value branch $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ and $g(x) = \cos^{-1}x$, having principal value brach $[0, \pi]$

The value of $f(\sin 10)$ is

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. Consider the function $f(x) = \sin^{-1}x$, having principal value branch $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ and $g(x) = \cos^{-1}x$, having principal value brach $[0, \pi]$

For $\sin^{-1}x < \frac{3\pi}{4}$, solution set of x 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. Match the following lists :

List I	List II
a. Number of roots of the equation $\sin^{-1}(\sin x) = \frac{x}{4}$ is	**p.** 2
b. Number of roots of the equation $\cos^{-1}(\cos x) = \frac{x}{4}$ is	**q.** 3
c. Number of roots of the equation $\tan^{-1}(\tan x) = \frac{x}{4}$ is	**r.** 4
d. Number of roots of the equation $\cot^{-1}(\cot x) = \frac{x}{4}$ is	**s.** 5

A. $\begin{matrix} a & b & c & d \\ s & r & q & p \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ q & s & r & p \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ s & r & p & q \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ q & r & q & p \end{matrix}$

Answer: D

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3. Match the following lists :

List I	List II
a. If $3\sin^{-1}x = \pi - \sin^{-1}(3x - 4x^3)$, then	p. $x \in \left[\frac{1}{\sqrt{2}}, 1\right]$
b. If $2\tan^{-1}x = \pi - \sin^{-1}\frac{2x}{1+x^2}$, then	q. $x \in \left[\frac{1}{2}, 1\right]$
c. If $2\tan^{-1}x = \pi + \tan^{-1}\frac{2x}{1-x^2}$, then	r. $x \in (1, \infty)$
d. If $2\sin^{-1}x = \pi - \sin^{-1}\left(2x\sqrt{1-x^2}\right)$, then	s. $x \in [1, \infty)$

A. $\begin{matrix} a & b & c & d \\ s & r & q & p \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ q & s & r & p \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ s & r & p & q \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ r & p & s & q \end{matrix}$

Answer: B

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4. Match the following carefully

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 $3\text{cosec}^2\left(\tan^{-1}u + \tan^{-1}v + \tan^{-1}w\right.$ 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. If

$\cos^{-1}(x) + \cos^{-1}(y) + \cos^{-1}(z) = \pi\left(\sec^2(u) + \sec^4(v) + \sec^6(w)\right)$, *whereu*, *v*, *w* are least non-negative angles such that `u

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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 $9\pi^2/b$ (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 π. 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 $\sin\left(\cos^{-1}\left(\tan\left(\sec^{-1}x\right)\right)\right)=\sqrt{1+x}is/are$ __

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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 $\cot\left(\sum_{n=1}^{23} \cot^{-1}\left(1 + \sum_{k=1}^{n} 2k\right)\right)$ is

A. $\frac{23}{25}$

B. $\frac{25}{23}$

C. $\frac{23}{24}$

D. $\frac{24}{23}$

Answer: B

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2. 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)

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 statements in List I with those in List II

List I	List II
a. A line from the origin meets the lines $\frac{x-2}{1}=\frac{y-1}{-2}=\frac{z+1}{1}$ and $\frac{x-\frac{8}{3}}{2}=\frac{y+3}{-1}=\frac{z-1}{1}$ at P and Q respectively. If length $PQ = d$, then d^2 is	**p.** 4
b. The value of x satisfying $\tan^{-1}(x+3)-\tan^{-1}(x-3)=\sin^{-1}\left(\frac{3}{5}\right)$ are	**q.** 0
c. Non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ satisfy $\vec{a}.\vec{b}=0$, $(\vec{b}-\vec{a}).(\vec{b}+\vec{c})=0$ and $2\lvert\vec{b}+\vec{c}\rvert=\lvert\vec{b}-\vec{a}\rvert$. If $\vec{a}=\mu\vec{b}+4\vec{c}$, then the possible values of μ are	**r.** 4
d. Let f be the function on $[-\pi, \pi]$ given by $f(0) = 9$ and $f(x)=\sin\left(\frac{9x}{2}\right)\Big/\sin\left(\frac{x}{2}\right)$ for $x \neq 0$. The value of $\frac{2}{\pi}\int_{-\pi}^{\pi} f(x)\,dx$ is	**s.** 5
	t. 6

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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. $\left(\frac{1}{y^2}\left(\frac{\cos(\tan^{-1}y)+y\sin(\tan^{-1}y)}{\cot(\sin^{-1}y)+\tan(\sin^{-1}y)}\right)^2+y^4\right)^{1/2}$ takes value	**p.** $\frac{1}{2}\sqrt{\frac{5}{3}}$
b. If $\cos x+\cos y+\cos z=0=\sin x+\sin y+\sin z$ then possible value of $\cos\frac{x-y}{2}$ is	**q.** $\sqrt{2}$
c. If $\cos\left(\frac{\pi}{4}-x\right)\cos 2x+\sin x\sin 2x\sec x$ $=\cos x\sin 2x\sec x+\cos\left(\frac{\pi}{4}+x\right)\cos 2x$ then possible value of sec x is	**r.** 1/2
d. If $\cot\left(\sin^{-1}\sqrt{1-x^2}\right)=\sin(\tan^{-1}(x\sqrt{6})), x\neq 0,$ then possible value of x is	**s.** 1

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 List I with List II and select the correct answer using the codes given below the lists :

List I	List
a. Let $y(x) = \cos(3\cos^{-1}x)$, $x \in [-1, 1]$, $x \neq \pm\frac{\sqrt{3}}{2}$. Then $\frac{1}{y(x)}\left\{(x^2-1)\frac{d^2y(x)}{dx^2} + x\frac{dy(x)}{dx}\right\}$ equals	**p.** 1
b. Let $A_1, A_2, \ldots, A_n$ $(n > 2)$ be the vertices of a regular polygon of n sides with its centre at the origin. Let $\vec{a}_k$ be the position vector of the point A_k, $k = 1, 2, \ldots n$. If $\left\lvert\sum_{k=1}^{n-1}(\vec{a}_k \times \vec{a}_{k+1})\right\rvert = \left\lvert\sum_{k=1}^{n-1}(\vec{a}_k \cdot \vec{a}_{k+1})\right\rvert$, then the minimum value of n is	**q.** 2
c. If the normal from the point $P(h, 1)$ on the ellipse $\frac{x^2}{6} + \frac{y^2}{3} = 1$ is perpendicular to the line $x + y = 8$, then the value of h is	**r.** 8
d. Number of positive solutions satisfying the equation $\tan^{-1}\left(\frac{1}{2x+1}\right) + \tan^{-1}\left(\frac{1}{4x+1}\right) = \tan^{-1}\left(\frac{2}{x^2}\right)$ is	**s.** 9

A. $\begin{matrix} a & b & c & d \\ s & r & p & q \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ q & s & r & p \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ s & r & p & q \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ q & s & p & r \end{matrix}$

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 $x \in [0, 4\pi]$ 4satisfying the 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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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. $(x_2 + x_3 + x_4)(x_3 + x_4 + x_1)(x_1 + x_2 + x_3) = abcd$

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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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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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 $\sec\left(\sin^{-1}\left(\sin\left(\frac{-50\pi}{9}\right)\right)+\cos^{-1}\left(\cos\left(\frac{31\pi}{9}\right)\right)\right)$

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. $\sin\cos^{-1}\tan\cot^{-1}x = \sqrt{1 - \frac{1}{x^2}}$

B. $\cos\tan^{-1}\cot\sin^{-1}x = x$

C. $\tan\cot^{-1}\sin\cos^{-1}x = \frac{1}{\sqrt{1 - x^2}}$

D. $\cot\sin^{-1}\cos\tan^{-1}x = \sqrt{1 - x^2}$

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. The number of solution (s) of the equation $\sin^{-1}(1 - x) - 2\sin^{-1}x = \frac{\pi}{2}$ is/are

A. $0, \frac{1}{2}$

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

C. 0

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

Answer: C

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33. If $\frac{\cos^{-1}\left(x^2-1\right)}{x^2+1}+\frac{\tan^{-1}(2x)}{x^2-1}=\frac{2\pi}{3}$, 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. The number of real solution of equation $\tan^{-1}x + \cot^{-1}(-|x|) = 2\tan^{-1}(6x)$ is

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 If $f(x + y) = f(x) + f(y) - xy - 1$, $\forall x, y$ in R and f(1)=1,*thenthevmberofsolutionof* f(n)=n, n in N ,` is

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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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. Find the number of solution of the equation $\cos\left(\cos^{-1}x\right) = \cos ec\left(\cos ec^{-1}x\right)$.

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

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4. 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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5. 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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6. 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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7. Find the values of a for which $\sin^{-1}x = |x - a|$ will have at least one solution.

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

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

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10. 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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11. 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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12. 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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13. 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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14. 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) $\left[-\frac{\pi}{2}, -1\right] \cup \left[1, \frac{\pi}{2}\right]$ (b) $\left[-\frac{\pi}{2}, 0\right] \cup \left[0, \frac{\pi}{2}\right]$ (c) $(-\infty, -1) \cup [1, \infty]$ (d) $[-1, 0] \cup [0, 1]$

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15. $\cos^{-1}\left(\cos\left(2\cot^{-1}\left(\sqrt{2}-1\right)\right)\right)$ is equal to $\sqrt{2}-1$ (b) $\frac{\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) *noneofthese*

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16. 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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17. 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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18. 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. $\frac{1}{4}$

Answer: A

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19. Solve the equation $\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = \tan^{-1}(-7)$

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

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21. If $0 < a_1 < a_2 < .... < a_n$, then prove that

$$\tan^{-1}\left(\frac{a_1x - y}{x + a_1y}\right) + \tan^{-1}\left(\frac{a_2 - a_1}{1 + a_2a_1}\right) + \tan^{-1}\left(\frac{a_3 - a_2}{1 + a_3a_2}\right) + ... + \tan^{-1}\left(\frac{a_n - a_{n-1}}{1 + a_na_{n-1}}\right)$$

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22. 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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23. 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 $9\pi^2/b$ (where a and b are coprime), then the value of b is ____

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24. 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

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25. $f(x) = \tan^{-1}x + \tan^{-1}\left(\frac{1}{x}\right)$; $g(x) = \sin^{-1}x + \cos^{-1}x$ are identical functions if (A)$x \in R$ (B) $x > 0$ (C) $x \in [-1, 1]$ (D) $x \in [0, 1]$

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26. If $\sin^{-1}a + \sin^{-1}b + \sin^{-1}c = \pi$, then the value of $a\sqrt{\left(1 - a^2\right)} + b\sqrt{\left(1 - b^2\right)} + \sqrt{\left(1 - c^2\right)}$ will be (A) $2abc$ (B) abc (C) $\frac{1}{2}abc$ (D) $\frac{1}{3}abc$

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

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

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30. If $\left|\sin^{-1}x\right| + \left|\cos^{-1}x\right| = \frac{\pi}{2}$, *then* (a)$x \in R$ (b) $[-1, 1]$ (c) $[0, 1]$ (d) φ

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31. Mean and standard deviation of 100 observations of are found to be 40 and 10. If at the time of calculation two observations are wrongly taken as 30 and 70 instead of 3 and 27 respectively. Find the correct standard deviation.

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32. 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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33. 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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34. Find the area bounded by $y = \sin^{-1}(\sin x)$ and $x = a\xi$ or $x \in [0, 100\pi]$

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

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

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

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

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

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

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

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

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44. 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) $3-\pi$

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45. If $2\tan^{-1}x+\frac{\sin^{-1}(2x)}{1+x^2}$ is independent of x, then $x>1$ (b) $x<-1$ (c) `0

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46. Equation $1+x^2+2x\sin\left(\cos^{-1}y\right)=0$ is satisfied by (a) exactly one value of x (b) exactly two value of x (c) exactly one value of y (d) exactly two value of y

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47. 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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48. 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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49. If $S_n = \cot^{-1}(3) + \cot^{-1}(7) + \cot^{-1}(13) + \cot^{-1}(21) + \ddot{n}$ 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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50. 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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51. If $\frac{\tan^{-1}\left(\sqrt{1+x^2}-1\right)}{x}=4^0$ then $x=\tan 2^0$ (b) $x=\tan 4^0$ $x=\frac{\tan 1}{4^0}$ (d) $x=\tan 8^0$

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52. The value of $2\tan^{-1}\left(\operatorname{cosec}\tan^{-1}x-\tan\cot^{-1}x\right)$ 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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53. The value of $\cot\left(\sum_{n=1}^{2}\cot^{-1}\left(1+\sum_{k=1}^{n}2k\right)\right)$ is (a) $\frac{23}{25}$ (b) $\frac{25}{23}$ (c) $\frac{23}{24}$ (d) $\frac{25}{26}$

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54. $\sin^{-1}(\sin 5) > x^2 - 4x$ hold if (a) $x = 2 - \sqrt{9 - 2\pi}$ (b) $x = 2 + \sqrt{9 - 2\pi}$ (c) $x > 2 + \sqrt{9 - 2\pi}$ (d) $x \in \left(2 - \sqrt{9 - 2\pi}, 2 + \sqrt{9 - 2\pi}\right)$

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55. The trigonometric equation $\sin^{-1}x = 2\sin^{-1}a$ has a solution for all real values

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56. If $f(x) = x^{11} + x^9 - x^7 + x^3 + 1$ and $f\left(\sin^{-1}(\sin 8)\right) = \alpha$, α is constant, then $f\left(\tan^{-1}(\tan 8)\right)$ is equal to (A) α (B) $\alpha - 2$ (C) $\alpha + 2$ (D) $2 - \alpha$

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57. 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 1 (b) 2 (c) $\frac{1}{2}$ (d) none of these

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58. The value of $\frac{\alpha^3}{2}\text{cosec}^2\left(\frac{1}{2}\frac{\tan^{-1}\alpha}{\beta}\right) + \frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\left(\frac{\beta}{\alpha}\right)\right) isequa < o$

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

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

Then the value of $\cos^{-1}\left(\frac{x^2}{2}\right) is \frac{\pi}{10}$ (b) $\frac{\pi}{5}$ (c) $\frac{2\pi}{5}$ (d) $\frac{4\pi}{5}$

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60. The value of $\tan\left(\sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right)\right)\tan\left(\cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right)\right)$, $wherex \in (0, 1)$, is equal to 0 (b) 1 (c) -1 (d) none of these

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61. 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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62. 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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63. 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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64. Find the range of $\cot^{-1}\left(2x - x^2\right)$

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

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

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

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

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

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69. 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 (are) $\frac{8\pi}{10}$ (b) $\frac{7\pi}{10}$ (c) $\frac{9\pi}{10}$ (d) $\frac{21\pi}{20}$

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70. If $\left(\sin^{-1}x + \sin^{-1}w\right)\left(\sin^{-1}y + \sin^{-1}z\right) = \pi^2$, then $D = \left|x^{N_1}y^{N_3}z^{N_3}w^{N_4}\right|\left(N_1, N_2, N_3, N_4 \in N\right)$ has a maximum value of 2 has a maximum value of 0 16 different D are possible has a minimum value of -2

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71. Indicate the relation which can hold in their respective domain for infinite values of x $\tan\left|\tan^{-1}x\right| = |x|$ (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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72. If $x < 0$, *then* $\tan^{-1}x$ is equal to

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73. 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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74. 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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75. If $\sin^{-1}x + \sin^{-1}y = \frac{\pi}{2}$ and $\sin 2x = \cos 2y$, 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)$y = \sqrt{\frac{1}{2} - \frac{\pi^2}{64}} - \frac{\pi}{8}$

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76. 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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77. 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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78. $\tan^{-1}\left[\frac{\cos x}{1 + \sin x}\right]$ is equal to $\frac{\pi}{4} - \frac{x}{2}, f$ or $x \in \left(-\frac{\pi}{2}, \frac{3\pi}{2}\right)$

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

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

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79. 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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80. 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 $\frac{\pi}{2}$ (b) $-\pi$ (c) π (d) $-\frac{\pi}{2}$

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

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83. 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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84. 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 0 (b) -1 (c) 1 (d) 2

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85. 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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86. 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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87. 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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88. $\sec^2\left(\tan^{01}2\right) + \operatorname{cosec}^2\left(\cot^{-1}3\right)$ is equal to 5 (b) 13 (c) 15 (d) 6

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89. 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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90. 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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91. If $\sin^{-1}x = \theta + \beta and \sin^{-1}y = \theta - \beta$, then $1 + xy$ is equal to $\sin^2\theta + \sin^2\beta$ (b) $\sin^2\theta + \cos^2\beta\ \cos^2\theta + \cos^2\theta$ (d) $\cos^2\theta + \sin^2\beta$

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

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94. 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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95. 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 $(\cos 1, 1)$ (b) $\cos 1, \cos 1)$ (c) $(\cot 1, 1)$ (d) none of these

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96. 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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97. 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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98. The value of x for which $\sin\left(\cot^{-1}(1+x)\right) = \cos\left(\tan^{-1}x\right)$ is $\frac{1}{2}$ (b) 1 (c) 0 (d) $-\frac{1}{2}$

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

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101. 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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102. 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 1

(b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{3}$ (d) $\frac{1}{3}$

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103. The number of real solutions of $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is a.*zero* b. one c. two d. infinite

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104. Which of the following quantities is/are positive? $\cos\left(\tan^{-1}(tan4)\right)$

(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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105. 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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106. 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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107. The number of real solutions of the equation $\sqrt{1 + \cos 2x} = \sqrt{2}\sin^{-1}(\sin x)$, $-\pi \leq x \leq \pi$ is 0 (b) 1 (c) 2 (d) infinite

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

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110. 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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111. 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) $\text{cosec}^{-1}\alpha$ (d) both $\cot^{-1}\alpha$ and $\cot^{-1}\beta$

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112. 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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113. 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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114. $2\tan^{-1}(-2)$ 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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115. 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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116. Prove that $\cos\tan^{-1}\sin\cot^{-1}x=\sqrt{\frac{x^2+1}{x^2+2}}$

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

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

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

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

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

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123. 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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124. 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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125. If $x < 0$, then prove that $\cos^{-1}x = \pi - \sin^{-1}\sqrt{1 - x^2}$

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

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127. 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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128. 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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129. 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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130. 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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131. If $u = \cot^{-1}\sqrt{\tan\alpha} - \tan^{-1}\sqrt{\tan\alpha}$, *then* $\tan\left(\frac{\pi}{4}, \frac{u}{2}\right)$ *isequa* $< o$ (a)$\sqrt{\tan\alpha}$ (b) $\sqrt{\cot\alpha}$ (c)$\tan\alpha$ (d) $\cot\alpha$

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132. 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

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

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

$(-1, 1)$

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135. 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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136. 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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137. 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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138. 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) $\frac{4\pi}{3}$ (d) $\frac{5\pi}{3}$

(e) none of these

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139. 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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140. 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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141. If $\sin\left(\frac{\sin^{-1}1}{5} + \cos^{-1}x\right) = 1$, then find the value of x.

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

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144. Find the value of

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

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

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

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147. 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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148. Solve $\sin^{-1}x \leq \cos^{-1}x$.

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149. 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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150. The value $2\tan^{-1}\left[\sqrt{\frac{a-b}{a+b}}\tan\frac{\theta}{2}\right]$ is equal to $\cos^{-1}\left(\frac{a\cos\theta+b}{a+b\cos\theta}\right)$ (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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151. If $\frac{1}{2}\sin^{-1}\left[\frac{3\sin2\theta}{5+4\cos2\theta}\right]=\tan^{-1}x$, *then* $x=$ (a)$\tan3\theta$ (b) $3\tan\theta$ (c) $\left(\frac{1}{3}\right)\tan\theta$ (d) $3\cot\theta$

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152. 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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153. 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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154. $\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}x\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}x\right)$, $x \neq 0$, is equal to x (b) $2x$ (c) $\frac{2}{x}$ (d) none of these

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155. 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

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

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156. 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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157. If

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

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

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158. 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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159. 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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160. 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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161. Solve the equation $\tan^{-1}2x + \tan^{-1}3x = \frac{\pi}{4}$

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

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163. $2\tan\left(\tan^{-1}(x) + \tan^{-1}\left(x^3\right)\right)$, *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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164. 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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165. 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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166. Find the value of $\sin^{-1}x + \frac{\sin^{-1}1}{x} + \cos^{-1}x + \frac{\cos^{-1}1}{x}$.

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

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

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

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171. Find the value of `tan^(-1)(1/2tan2A)+tan^(-1)(cotA)+tan^(-1)(cot^3A),for0

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172. Simplify $\frac{3\sin 2\alpha}{5+3\cos 2\alpha}+\tan^{-1}\left(\tan\left(\frac{\alpha}{4}\right)\right)$, where $-\frac{\pi}{2}<\alpha<\frac{\pi}{2}$

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173. $\sum_{r=1}^{n}\sin^{-1}\left(\frac{\sqrt{r}-\sqrt{r-1}}{\sqrt{r(r+1)}}\right)$ 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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174. 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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175. The numerical value of $\tan\left(2\tan^{-1}\left(\frac{1}{5}\right)-\frac{\pi}{4}\right)$ is equal to____

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176. 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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177. 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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178. If `y=tan^(-1)1/2+tan^(-1)b ,(0

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179. 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 0 (b) 1 (c) 2 (d) Infinite solutions

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180. If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \frac{\pi}{2}$, *then* $x + y + z - xyz = 0$ $x + y + z + xyz = 0$ $xy + yz + zx + 1 = 0$ $xy + yz + zx - 1 = 0$

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181. 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 π (b) $\frac{\pi}{2}$ (c) 0 (d) none of these

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182. 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 $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ (b) $xyz\ xy + yz + zx$ (d) none of these

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183. If $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi, then \quad x^2 + y^2 + z^2 + xyz = 0$

$x^2 + y^2 + z^2 + 2xyz = 0\ x^2 + y^2 + z^2 + xyz = 1\ x^2 + y^2 + z^2 + 2xyz = 1$

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184. If `0

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185. 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

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

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

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188. 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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189. Solve $\sin^{-1}x\leq\cos^{-1}x$

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

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191. If $a_1, a_2, a_3, , a_n$ is an A.P. with common difference d, then prove that

$$\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\tan^{-1}\left(\frac{d}{1+a_{n-1}a_n}\right)\right]=\frac{(n-1)d}{1+a_1a_n}$$

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

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

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

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

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

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

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

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

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

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202. Solve $\sin^{-1}x \succ 1$

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

$\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

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204. 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 9 (b) -9 (c) -3 (d) -1

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

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206. $\tan^{-1}\left(\frac{x}{y}\right)-\tan^{-1}\left(\frac{x-y}{x+y}\right)$ 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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207. 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) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ $\left[\frac{2\pi}{3}, \frac{4\pi}{3}\right]$ (d) $\left[-\frac{3\pi}{6}, \frac{7\pi}{6}\right]$

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208. If $\sin^{-1}\left(\frac{5}{x}\right) + \sin^{-1}\left(\frac{12}{x}\right) = \frac{\pi}{2}$, then x is equal to $\frac{7}{13}$ (b) $\frac{4}{3}$ (c) 13 (d) $\frac{13}{7}$

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209. 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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210. 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 x and y.

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

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212. 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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213. 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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214. 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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215. Solve for real values of x: $\dfrac{\left(\sin^{-1}x\right)^3 + \left(\cos^{-1}x\right)^3}{\left(\tan^{-1}x + \cot^{-1}x\right)^3} = 7$

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

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

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218. 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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219. 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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220. Find the domain for $f(x) = \sin^{-1}\left(\frac{1+x^2}{2x}\right)$

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221. 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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222. 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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223. Solve $\sin^{-1}x - \cos^{-1}x = \sin^{-1}(3x - 2)$

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224. 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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225. 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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226. 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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227. If $\frac{\cos^{-1}(6x)}{1+9x^2} = -\frac{\pi}{2} + \tan^{-1}3x$, then find the value of x.

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228. 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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229. 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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230. Find the value of $2\cos^{-1}\left(\frac{3}{\sqrt{13}}\right) + \cot^{-1}\left(\frac{16}{63}\right) + \frac{1}{2}\cos^{-1}\left(\frac{7}{25}\right)$

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

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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 $\log_{\pi}x > 0$ 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. If $\sin^{-1}(\sin 4)^{-1} + \cos^{-1}(\cos 8) + \tan^{-1}(\tan 6) + \cot^{-1}.(\cot 10) = a \div b\pi$, then $(a + b)$ equals where a and b are co-prime then find the value of $\left(a^3 + b^3\right)$.

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4. Total number of ordered pairs (x, y) satisfying |y|=cos x and $y = \sin^{-1}(\sin x)$ where $x \in [0, 3\pi]$ is equal to

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5. Find the number of points $x \in \left[-\frac{\pi}{2}, \frac{3\pi}{2}\right]$ satisfying the equation $1 + \sin^{-1}(\sin x) = \frac{\pi}{3}$.

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

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7. 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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8. Given $f(x) = \tan^{-1}(\cot x) + \cot^{-1}(\tan x), \left(\frac{\pi}{2} < x < \pi\right)$, then $\left|f'\left(\frac{2\pi}{3}\right) - f'\left(\frac{5\pi}{6}\right)\right|$ is equal to

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9. If all the roots of the equation $x^3 - 3x = 0$ satisfy the equation $\left(\alpha - \sin^{-1}(\sin 2)\right)x^2 - \left(\beta - \tan^{-1}(\tan 1)\right)x \div y^2 - 2y + 1 = 0$, then find the value of $|\cot(\beta + \gamma) + \cot\alpha|$.

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10. If the solution set of inequality $\left(\text{cosec}^{-1}x^2\right) - 2\text{cosec}^{-1}x \geq \frac{\pi}{6}\left(\text{cosec}^{-1}x - 2\right)$ is $(-\infty, m] \cup [n, \infty)$ then $(m + n)$ equals

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11. Find the sum of the values of x satisfying the equation $\tan^{-1}\left(\frac{2x - 1}{10}\right) + \tan^{-1}\left(\frac{1}{2x}\right) = \sum_{n=2}^{3}\cot^{-1}(n)$.

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12. Number of values of x satisfying the equation $\cos\left(\frac{4\pi}{3} - \cos^{-1}x\right) = x$, is

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13. If the value of expression $\sin^{-1}\left(\sin 2013^\circ\right) + \cos^{-1}\left(\cos.2013^\circ\right) + \tan^{-1}\left(\tan 2013^\circ\right)$ is equal to $\left(k^\circ\right)$ where $k \in N$ then find the value of sqrt(k/3) .

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14. Let $f:[0, 3\pi] \to \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ be defined by $f(x) = \sin^{-1}(\sin x)$.Find the number of points $x \in [0, 3\pi]$ satisfying the equation $f(x) = \frac{9 - x}{9}$.

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15. function $f(x) = \frac{arot\frac{x}{2} + opera \to rnamearot\frac{x}{3}}{\frac{\arctan x}{2} + \frac{\arctan x}{3}}$, then f(1) is equal to

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16. If m and M are the least and the greatest value of $\left(\cos^{-1}x\right)^2 + \left(\sin^{-1}x\right)^2$, then $\frac{M}{m} =$

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17. Solution of the equation $\cot\left(\sum_{r=1}^{4}\cot^{-1}2r^2\right) = \frac{3x+4}{3x+2}$ is equal to

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18. If the equation $\sin^{-1}x = \text{cosec}^{-1}x$ is satisfied for α and β, $(\alpha \neq \beta)$, then $\alpha + \beta$ is equal to

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19. Let $f(x) = \sin^5 x - \cos^2 x$ and $g(x) = \cot^{-1}\left(x^2 + x + 1\right)$. Number of solution of the equation $f(x) = sgn(g(x))$ in $(-2\pi, 2\pi)$ is

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20. The value of `3 sin (1/2 arc cos 1/9) +4 cos (1/2 arc cos 1/8) equal to

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21. If $\alpha = \sin\left(\frac{\sin^{-1}(1)}{\sqrt{3}}\right)\beta = \cos\left(\cos^{-1}\left(\frac{1}{\sqrt{5}}\right) - \sin^{-1}\left(\frac{2}{\sqrt{5}}\right)\right)$ then $\frac{\beta^2}{\left(3\alpha - 4\alpha^3\right)^2}$ is equal to

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22. Number of integers in the domain of $\cos^{-1}\left(\log_2\left(\frac{x}{3}\right)\right)$ is

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23. Let $x = \tan^{-1}(\tan 2) + \tan\left(\tan^{-1}2\right)$, $then [x] + sgn(x)$ is equal to (where [.] denotes G.I.F.)

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24. If $\sum_{i=1}^{10}\left(\cos^{-1}x_i + \cos^{-1}y_1\right) = 20\pi$, then the value of $\sum_{I\le 1}\sum_{I\le 10}x_i y_j$ is

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