# MATHS

## BOOKS - KC SINHA ENGLISH

## INVERSE CIRCULAR FUNCTIONS - FOR COMPETITION

### Solved Examples

**1.** Find the angle $\sin^{-1}(\sin 10)$

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**2.** The value of $3\tan^{-1}\frac{1}{2}+2\tan^{-1}\frac{1}{5}+\sin^{-1}\frac{142}{65\sqrt{5}}$ is :

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**3.** Evaluate : $\cos\left(2\cos^{-1}x+\sin^{-1}x\right)atx=\frac{1}{5}$

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**4.** Show that $\frac{1}{2}\cos^{-1}\left(\frac{3}{5}\right)=\tan^{-1}\left(\frac{1}{2}\right)$

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**5.** 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 show

.

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**6.** If $0<a_1<a_2<\ldots.<a_n,$ then prove that

$\tan^{-1}\left(\frac{a_1x-y}{x+a_1y}\right)+\tan^{-1}\left(\frac{a_2-a_1}{1+a_2a_1}\right)+\tan^{-1}\left(\frac{a_3-a_2}{1+a_3a_2}\right)+\ldots\ldots+t$

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**7.** Show that : $2\tan^{-1}x + \frac{\sin^{-1}(2x)}{1+x^2}$ is constant for $x \geq 1$, find that constant.

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**8.** Prove the relation, $s_t = u + at - \frac{1}{2}a$.

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**9.** If the points $(a_1, b_1)$, $(a_2, b_2)$ and $(a_1 + a_2, b_1 + b_2)$ are collinear, show that $a_1 b_2 = a_2 b_1$ .

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**10.** Using mathematical induction , prove that $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \ldots . + \tan^{-1}\left(\frac{1}{n^2+n+1}\right) = \tan^{-1}\left(\frac{n}{n+

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**11.** 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 $\tan^{-1} x_1 + \tan^{-1} x_2 + \tan^{-1} x_3 + \tan^{-1} x_4 = \left(\frac{\pi}{2}\right) - \beta.$

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**12.** If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$ and $x + y + z = \frac{3}{2},$ then prove that $x = y = z$

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**13.** If $\sin^{-1} x = \sin^{-1} y + \sin^{-1} z = \pi$ , prove that $x^4 + y^4 + z^4 + 4x^2y^2z^2 =$

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**14.** Find all possible values of x and y for which

$$\cos^{-1}\sqrt{x}+\cos^{-1}\sqrt{1-x}+\cos^{-1}\sqrt{1-y}=\left(\frac{3\pi}{4}\right.$$

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**15.** The number of positive integral solutions of $\tan^{-1}x+\cot^{-1}y=\tan^{-1}3$ is :

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**16.** 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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**17.** Convert the trigonometric function $\sin\left[2\cos^{-1}\left\{\cot\left(2\tan^{-1}x\right)\right\}\right]$ into an algebraic function $f(x)$. Then from thealgebraic functionfind all the values of x for which $f(x)$ is zero. Express the values of x in the form $a \pm \sqrt{b}$ where a and b are rational numbers.

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**18.** The value(s) of $\theta$ satisfying the equation $\theta = \tan^{-1}(2\tan^2\theta) - \frac{1}{2}\left(\sin^{-1}\left(\frac{3\sin 2\theta}{5+4\cos 2\theta}\right)\right)$ is

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

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**21.** If $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-..\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}\right)=\frac{\pi}{2}$ for

`0<|x|

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

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

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

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**25.** A solution of $\sin^{-1}(1)-\sin^{-1}\left(\frac{\sqrt{3}}{x^2}\right)-\frac{\pi}{6}=0$ is (A) $x=-\sqrt{2}$ (B) $x=\sqrt{2}$ (C) $x=2$ (D) $x=\frac{1}{\sqrt{2}}$

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**26.** Statement 1. If $x, 0, \tan^{-1}x+\tan^{-1}\left(\frac{1}{x}\right)=\frac{\pi}{2}$, Statement 2. $\tan^{-1}x+\cot^{-1}x=\frac{\pi}{2}, \forall x \varepsilon R$ (A) Both Statement 1 and Statement 2 are true and Statement 2 is the correct explanation of Statement 1 (B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1 (C) Statement 1 is true but Statement 2 is false. (D) Statement 1 is false but Statement 2 is true

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**27.** Statement 1. If $\sin^{-1}x=\cos^{-1}x, thenx=\frac{1}{\sqrt{2}}$, Statement 2. $\sin^{-1}x+\cos^{-1}x=\frac{\pi}{2}, 1\leq x\leftarrow 1$ (A) Both Statement 1 and

Statement 2 are true and Statement 2 is the correct explanation of Statement 1 (B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1 (C) Statement 1 is true but Statement 2 is false. (D) Statement 1 is false but Statement 2 is true

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**28.** the value of $\cos\left(\cos^{-1}x+\sin^{-1}(x-2)\right)$ is equal to (A) 0 (B) 1 (C) -1 (D) $\sqrt{1-x^2}.\sqrt{x^2-4x+3}+x(x-2)$

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**29.** The value of $\sin\left(\sin^{-1}\left(\frac{1}{2}\right)+\cos^{-1}\left(\frac{1}{3}\right)\right)$ is equal to (A) $\left(\frac{\sqrt{3}+\sqrt{8}}{6}\right)$ (B) $\left(\frac{1+2\sqrt{6}}{6}\right)$ (C) $-\left(\frac{1+2\sqrt{6}}{6}\right)$ (D) 0

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**30.** The minimum value of $\frac{x}{(\log)_e x}$ is $e$ (b) $1/e$ (c) 1 (d) none of these

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**31.** $\sum_{i=1}^{\infty} \tan^{-1}\left(\frac{1}{2i^2}\right) = t, then \tan t =$

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**32.**

$\text{Let} \quad f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)\right), \quad \text{where} \quad -\frac{\pi}{4} < \theta < \frac{\pi}{4}. \quad \text{Then th}$

is -

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Exercise

**1.** Find the value of :$\cot^{-1}\left(\cot\left(\frac{5\pi}{4}\right)\right)$

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**2.** The value of $\sin^{-1}(\sin 5)$ is $5 - 2\pi$

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**3.** Write the value of $\cos^{-1}\left(\cos\left(5\frac{\pi}{4}\right)\right)$.

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**4.** evaluate $\cos^{-1}\cos 10$

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**5.** Find the value of the expression: $\sin\left(2\frac{\tan^{-1}1}{3}\right) + \cos\left(\tan^{-1}2\sqrt{2}\right)$

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**6.** Prove that : $\cot^{-1}7+\cot^{-1}8+\cot^{-1}18=\cot^{-1}3$

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**7.** Prove that: $\sin^{-1}\left(\frac{3}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)+\cot^{-1}\left(\frac{56}{33}\right)=\frac{\pi}{2}$

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**8.** Prove that : $2\cot^{-1}5+\cot^{-1}7+2\cot^{-1}8=\frac{\pi}{4}.$

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**9.** Prove that : tan^(-1) 1 + tan^(-1) 2 + tan^(-1) 3= pi = 2(tan^(-1) 1 + tan^(-1),

(1)/(2) + tan^(-1), (1)/(3))`

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**10.** If $\tan A = \frac{1}{7} and \tan B = \frac{1}{3}$, show that $\cos 2A = \sin 4B$.

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**11.** Find the sum

$$\tan^{-1}\left(\frac{x}{1+1.2x^2}\right) + \tan^{-1}\left(\frac{x}{1+2.3x^2}\right) + \ldots + \tan^{-1}\left(\frac{x}{1+n(n+1)x\right.$$

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**12.** If $a_1, a_2, a_3, a_n$ are in arithmetic progression with common difference $d,$ then evaluate the following expression:

$$\tan\left\{\tan^{-1}\left(\frac{d}{1+a_1a_2}\right) + \tan^{-1}\left(\frac{d}{1+a^2a_3}\right) + \tan^{-1}\left(\frac{d}{1+a_3a_4}\right) + +\right.$$

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**13.** The inequality $\sin^{-1}(\sin 5) > x^2 - 4x$ holds for

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**14.** The value of cos(sin −1 (tan(cos −1 (sin(tan −1 ( 4/3 ))))))

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**15.** Prove that:

$$\frac{\alpha^3}{2}\cos ec^2\left(\frac{1}{2}\frac{\tan^{-1}\alpha}{\beta}\right)+\frac{\beta^3}{2}\sec^2\left(\frac{1}{2}\frac{\tan^{-1}\beta}{\alpha}\right)=(\alpha+\beta)\left(a^2+\beta^2\right).$$

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**17.** If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\pi$ , prove that:

$$x\sqrt{1-x^2}+y\sqrt{1-y^2}+z\sqrt{1-z^2}=2xyz$$

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**18.** Express: $\cot^{-1}\left(\frac{y}{(1-x^2-y^2)}\right) = 2\tan^{-1}\sqrt{\frac{3-4x^2}{4x^2}} - \frac{\tan^{-1}\sqrt{3-4x^2}}{x^2}$ as a rational integral equation in x and y.

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**19.** If $\frac{m\tan(\alpha-\theta)}{\cos^2\theta} = \frac{n\tan\theta}{\cos^2(\alpha-\theta)}$

Prove that : $\theta = \frac{1}{2}\left[\alpha - \tan^{-1}\left(\frac{n-m}{n+m}\tan\alpha\right)\right]$

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**20.** If $\sin^{-1}\left(\frac{x}{a}\right) + \sin^{-1}\left(\frac{y}{b}\right) = \sin^{-1}\left(\frac{c^2}{ab}\right)$ then prove that $b^2x^2 + 2xy\sqrt{a^2b^2-c^2} = c^4 - a^2y^2 - 2x^2y^2$

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**21.** Prove that:

$$\tan^{-1}(t) + \tan^{-1}\left(\frac{2t}{1-t^2}\right) = \tan^{-1}\left(\frac{3t-t^3}{1-3t^2}\right), \quad \text{if} \quad -\frac{1}{\sqrt{3}}, t < \frac{1}{\sqrt{3}}$$

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**22.** $\cos^{-1}\left(\sqrt{\frac{a-x}{a-b}}\right) = \sin^{-1}\left(\sqrt{\frac{x-b}{a-b}}\right)$ is possible, if

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**23.** Prove that: $\sin\cos^{-1}\tan\sec^{-1}x = \sqrt{2-x^2}$

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**24.** Solve: $\frac{\sin^{-1}(3x)}{5} + \frac{\sin^{-1}(4x)}{5} = \sin^{-1}x$

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**25.** Solve : $\tan^{-1}(x-1)+\tan^{-1}x+\tan^{-1}(x+1)=\tan^{-1}3$

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

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**27.** If k be a positive integer , show that the equation $\tan^{-1}x+\tan^{-1}y=\tan^{-1}k$ has no positive integral solution.

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**28.** Solve the equation $\frac{\tan^{-1}(x+1)}{x=1}+\frac{\tan^{-1}(x-1)}{x}=\tan^{-1}(-7)$

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29. If $\tan^{-1}\left(\frac{2x}{x^2-1}\right)+\cos^{-1}\left\{\frac{x^2-1}{x^2+1}\right\}=\frac{2\pi}{3}$ then $x=$

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30. If $A=\tan^{-1}\left(\frac{x\sqrt{3}}{2k-x}\right)$ and $B=\tan^{-1}\left(\frac{2x-k}{k\sqrt{3}}\right)$, then the value of $A-B$ is :

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

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**33.** Solve: $\sin^{-1}(x) + \sin\left(\sqrt{1-x^2}\right) =$

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**34.** If x, y, z are in A.P. and $\tan^{-1} x, \tan^{-1} y$ and $\tan^{-1} z$ are also in A.P. then show that x=y=z and y≠0

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**35.** Find $\sum_{k=1}^{n} \frac{\tan^{-1}(2k)}{2+k^2+k^4}$

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**36.** Sum of infinite terms of the series

$\cos^{-1}\left(1^2+\frac{3}{4}\right) + \cot^{-1}\left(2^2+\frac{3}{4}\right) + \cot^{-1}\left(3^2+\frac{3}{4}\right) + \ldots$ is

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

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**38.** Find the number of solution of the equation $|y|=\sin x$ and $y=\cos^{-1}\cos x$ where $-2\pi\leq x\leq 2\pi$

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

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**40.** 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

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**41.** find the value sec−1[sec(−30)]=?

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**42.** Solve for $x:\ 3\dfrac{\sin^{-1}(2x)}{1+x^2}-4\dfrac{\cos^{-1}(1-x^2)}{1+x^2}+2\dfrac{\tan^{-1}(2x)}{1-x^2}=\dfrac{\pi}{3}$

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

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

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

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

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**44.** The value of $\sin^{-1}(-\sqrt{3}/2)$ is- a.$-\pi/3$ b. $-2\pi/3$ c.$4\pi/3$ d. $5\pi/3$

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**45.** If $\alpha, \beta, \gamma$ re the roots of the equations$x^3 + px^2 + 2x + p = 0$ then the general value of $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma$ is (A) $n\pi$ (B) $\frac{n\pi}{2}$ (C) $(2n+1)\frac{\pi}{2}$ (D) dependent upon the value of p.

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**46.** Principal value (s) of $\cos^{-1}\left(-\frac{1}{2}\right) is(are)$ (A) $\frac{\pi}{6}$ radian (B) $\left(2n\pi + \frac{2\pi}{3}\right)$ radian (C) $\frac{2\pi}{3}$ radian (D) $\frac{4\pi}{3}$ radian

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**47.** If $\sin^{-1}\left(\frac{1}{3}\right) + \sin^{-1}\left(\frac{2}{3}\right) = \sin^{-1}x$ then x is equal to (A) $\left(4 + \frac{\sqrt{5}}{9}\right.$ (B) $\left(4\sqrt{2} + \frac{\sqrt{5}}{9}\right.$ (C) $\frac{\sqrt{3}+1}{6}$ (D) 1

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**48.** If $\sin^{-1}x + \cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}, \ then\ x$ is 0 b. $\frac{1}{\sqrt{5}}$ c. $\frac{2}{\sqrt{5}}$ d. $\frac{\sqrt{3}}{2}$

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

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**50.** $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) + \ldots\ldots\infty =$

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**51.** If $\frac{\cos^{-1}x}{2} + \frac{\cos^{-1}y}{3} = \theta$ , then $9x^2 - 12xy\cos\theta + 4y^2$ is equal to

(a) 36 (b) $-36\sin^2\theta$ (c) $36\sin^2\theta$ (d) $36\cos^2\theta$

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**52.** If $\cot^{-1}(\sqrt{\cos\alpha}) - \tan^{-1}(\sqrt{\cos\alpha}) = x$, 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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**53.** The value of $\sin(\cot^{-1}x) =$ (A) $\sqrt{1+x^2}$ (B) x (C) $(1+x^2)^{-\frac{3}{2}}$ (D) $(1+x^2)^{-\frac{1}{2}}$

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**54.** The value of $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) + \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is equal to (A) $\sin^{-1}\left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)$ (B) $\pi - \sin^{-1}\left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)$ (C) $\pi + \sin^{-1}\left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)$

(D) none of these

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**55.** $\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\sin^{-1}x$ is true if $x \in [0,\ 1]$ b. $\left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$ c. $\left[-\frac{1}{2}, \frac{1}{2}\right]$ d. $\left[-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}\right]$

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**56.** If $\cot^{-1}.\ \frac{n}{\pi} > \frac{\pi}{6}, n \in N$, then find the maximum value of n.

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

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

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**58.** If $\sum_{i=1}^{10} \sin^{-1}x_i = 5\pi then \sum_{i=1}^{10} x_i^2 =$ (A) 0 (B) 5 (C) 10 (D) none of these

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**59.** If $x = \sin\left(2\tan^{-1}2\right)$ and $y = \sin\left(\frac{1}{2}\tan^{-1}.\ \frac{4}{3}\right)$, then prove that y^2 = 1 - x

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**60.** If $\tan^{-1}(x+h) = \tan^{-1}(x) + (h\sin y)(\sin y) - (h\sin y)^2.\ \frac{\sin^2 y}{2} + (h\sin y$

then (A) $y = \tan^{-1}x$ (B) $y = \sin^{-1}x$ (C) $y = \cot^{-1}x$ (D) $y = \cos^{-1}x$

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**61.** Solutions set of $\left[\sin^{-1}x\right] > \left[\cos^{-1}x\right]$, where[.] denotes the greatest integer function, is

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**62.** The number of real solutions (x, y), where $|y| = \sin x, y = \cos^{-1}(\cos x), \ -2\pi \le x \le 2\pi$, is :

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**63.** If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$ and $f(1) = 2, f(p+q) = f(p) \cdot f(q)$, , then the value of $x^{f(1)} + x^{f(2)} + z^{f(3)} - \left(\frac{x+y+z}{x^{f(1)} + y^{f(2)} + z^{f(3)}}\right)$ is :

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**64.** If $\tan^{-1}x + \tan^{-1}2x + \tan^{-1}3x = \pi$, then (A) $x = 0$ (B) $x = 1$ (C) $x = -1$ (D) $x \varepsilon \phi$

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**65.** The real solutions of the equation $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

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**66.** The complete solution set of the inequality $(\cos^{-1}x)^2 - (\sin^{-1}x)^2 > 0$ is :

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

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**68.** $\sin^{-1}(\sin 5) > x^2 - 4x$ hold if $x = 2 - \sqrt{9-2\pi}$ $x = 2 + \sqrt{9-2\pi}$ $x > 2 + \sqrt{9-2\pi}$ $x \in \left(2 - \sqrt{9-2\pi}, 2 + \sqrt{9-2\pi}\right)$

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69. $\sum_{n=1}^{\infty} \sin^{-1}\left(\frac{\sqrt{n}-(\sqrt{n-1})}{\sqrt{(n)(n+1)}}\right)=$ (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) $-\frac{\pi}{3}$ (D) $\frac{\pi}{3}$

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70. $\sin^{-1}\left(\sin\left(\frac{7\pi}{6}\right)\right)=$ (A) $\frac{7\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $-\frac{\pi}{6}$ (D) none of these

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71. $\cos^{-1}\left\{-\sin\left(\frac{5\pi}{6}\right)\right\}=$ (A) $-\frac{5\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{2\pi}{3}$ (D) $-\frac{2\pi}{3}$

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72. $\sin^{-1}\left(\cos\left(\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)\right)=$ (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $-\frac{\pi}{6}$ (D) none of these

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**73.** $\sin^{-1}\left(-\frac{1}{2}\right)+\tan^{-1}(\sqrt{3})=$ (A) $-\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{6}$ (D) none of these

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**74.** $\sum_{i=1}^{2n}\sin^{-1}(x_i)=n\pi$ then the value of $\sum_{i=1}^{n}\cos^{-1}x_i+\sum_{i=1}^{n}\tan^{-1}x_i=$ (A) $\frac{n\pi}{4}$ (B) $\left(\frac{2}{3}\right)n\pi$ (C) $\left(\frac{5}{4}\right)n\pi$ (D) $2n\pi$

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

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**76.** 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

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**77.** If the mapping $f(x)=mx+c, m>0$ maps $[-1, 1]$ onto $[0, 2]$, then $\tan\left(\tan^{-1}.\frac{1}{7}+\cot^{-1}8+\cot^{-1}18\right)$ is equal to

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**78.** If $e^{\log_{e} 2\left[\sin^2\alpha+\sin^4\alpha+\sin^6\alpha+\ldots\to\infty\right]}$ is a root of equation $x^2-9x+8=0 where 0<\alpha<\frac{\pi}{2}$ then the principal value of $\sin^{-1}\left(\frac{2\pi}{3}\right)$ is

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

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**80.** Prove that $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 = \pi$

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**81.** Prove that : $\tan\left(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right) + \frac{7}{17} = 0$

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**82.** Which one of the following is correct? (A) $\tan 1 > \tan^{-1}(1)$ (B) $\tan < \tan^{-1}(1)$ (C) $\tan 1 = \tan^{-1}(1)$(D) none of these

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**83.** Evaluate : $\cos\left(2\cos^{-1} x + \sin^{-1} x\right) at x = \frac{1}{5}$

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

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**85.** If $\alpha, \beta$ and $\gamma$ are the three angles with $\alpha = 2\tan^{-1}(\sqrt{2}-1); \beta = 3\sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ and $\gamma = \cos^{-1}\left(\frac{1}{3}\right)$, find the relation between alpha ,beta and gamma

A. α<γ

B. null

C. null

D. null

**Answer: null**

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**86.** If $0 < x < 1$, then $\tan^{-1}\frac{\sqrt{1-x^2}}{1+x}$ is equal to

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**87.** 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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**88.** The value of $\tan\left\{\frac{1}{2}\sin^{-1}\left(\frac{2x}{1+x^2}\right)+\frac{1}{2}\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right\}$ is (A) $\frac{2x}{1-x^2}$ (B) $\frac{2x}{1-x^2}$ (C) not defined if $x. \geq 1$ (D) 0

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**89.** The sum $\sum_{n=1}^{\infty}\tan^{-1}\left(\frac{4n}{n^4-2n^2+2}\right)$ is equal to

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**90.** Indicate the relation which can hold in their respective domain for infinite values of $x\cdot$ $\tan\left|\tan^{-1}x\right|=|x|$ (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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**91.** If $\cos^{-1}\left(\frac{x^2-1}{x^2+1}\right)+\tan^{-1}\left(\frac{2x}{x^2-1}\right)=\frac{2\pi}{3}$, then x equal to (A) $\sqrt{3}$ (B) $2+\sqrt{3}$ (C) $2-\sqrt{3}$ (D) $-\sqrt{3}$

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**92.** $2\cot^{-1}7+\cos^{-1}\left(\frac{3}{5}\right)$ is equal to (A) $\cot^{-1}\left(\frac{44}{117}\right)$ (B) $\cos ec^{-1}\left(\frac{125}{117}\right)$ (C) $\tan^{-1}\left(\frac{44}{117}\right)$ (D) $\cos^{-1}\left(\frac{44}{125}\right)$

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**93.** $\sin^{-1}x > \cos^{-1}x$ holds for

(A) all value of x

(B) $x\varepsilon\left(0, \frac{1}{\sqrt{2}}\right)$

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

(D) $x = 0.75$

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**94.** Consider f(x)=sin −1 (sec(tan −1 x)+cos −1 (cosec(cot −1 x) Statement-1: Domain of f(x) is a singleton. Statement-2: Range of the function f(x) is a singleton.

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**95.** Statement 1. $\tan\left[\cos^{-1}\left(\frac{1}{\sqrt{82}}\right) - \sin^{-1}\left(\frac{5}{\sqrt{26}}\right)\right]$ is equal to $\frac{29}{3}$, Statement 2. $\left\{x\cos\left(\cot^{-1}x\right) + \sin\left(\cot^{-1}x\right)\right\}^2 = \frac{51}{50}$, when $x = \frac{1}{5\sqrt{2}}$

(A) Both Statement 1 and Statement 2 are true and Statement 2 is the correct explanation of Statement 1

(B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1

(C) Statement 1 is true but Statement 2 is false.

(D) Statement 1 is false but Statement 2 is true

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**96.** Statement I $\cos ec^{-1}\left(\frac{1}{2}+\frac{1}{\sqrt{2}}\right) > \sec^{-1}\left(\frac{1}{2}+\frac{1}{\sqrt{2}}\right)$

Statement II $\cos ec^{-1}x > \sec^{-1}x, \text{ if } \ 1 \leq x < \sqrt{2}$

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**97.** Statement 1. $\cos^{-1}x - \sin^{-1}\left(\frac{x}{2}+\frac{\sqrt{(3-3x^2)}}{2}\right) = -\frac{\pi}{3}, where \frac{1}{2} \leq x \leq 1,$

Statement 2. $2\sin^{-1}x = \sin^{-1}2x\sqrt{1-x^2}, where -\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}.$

(A) Both Statement 1 and Statement 2 are true and Statement 2 is the correct explanation of Statement 1

(B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1

(C) Statement 1 is true but Statement 2 is false.

(D) Statement 1 is false but Statement 2 is true

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**98.** Statement 1. If $x, 0, \tan^{-1} x + \frac{\tan^{-1} 1}{x} = \frac{\pi}{2}$, Statement 2. $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}, \forall x \varepsilon R$ (A) Both Statement 1 and Statement 2 are true and Statement 2 is the correct explanation of Statement 1 (B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1 (C) Statement 1 is true but Statement 2 is false. (D) Statement 1 is false but Statement 2 is true

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**99.** $Let \alpha = \tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right)$, $\beta = \cos^{-1}\left(\frac{2}{3}\right) + \cos^{-1}\left(\frac{\sqrt{5}}{3}\right)$,

$$\gamma = \sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right) + \frac{1}{2}\cos^{-1}\left(\cos\left(\frac{2\pi}{3}\right)\right)$$

The value of $\cos(\alpha + \beta + \gamma)$ is equal to

(A) $\cos\left(\frac{5\pi}{12}\right)$ (B) $\cos\left(\frac{7\pi}{12}\right)$ (C) $-\cos\left(\frac{\pi}{12}\right)$ (D) $-\cos\left(\frac{7\pi}{12}\right)$

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**100.** $Let \alpha = \tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right)$,

$$\beta = \cos^{-1}\left(\frac{2}{3}\right) + \cos^{-1}\left(\frac{\sqrt{5}}{3}\right),$$

$$\gamma = \sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right) + \frac{1}{2}\cos^{-1}\left(\cos\left(\frac{2\pi}{3}\right)\right)$$

then $\sin \cot^{-1} \tan \cos^{-1}(\sin \gamma)$ is equal to

(A) $2 \sin \gamma$ (B) $\sin\left(\frac{\gamma}{2}\right)$ (C) $\frac{1}{2}\sin \gamma$ (D) $\cos \gamma$

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**101.** Let $\alpha = \tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right)$,

$$\beta = \cos^{-1}\left(\frac{2}{3}\right) + \cos^{-1}\left(\frac{\sqrt{5}}{3}\right),$$

$$\gamma = \sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right) + \frac{1}{2}\cos^{-1}\left(\cos\left(\frac{2\pi}{3}\right)\right)$$

thencos $\alpha + \cos\beta + \cos\gamma$ is equal to

(A) $\frac{\sqrt{2}-1}{2}$ (B) $\frac{\sqrt{2}+1}{2}$ (C) $\frac{\sqrt{2}+\sqrt{3}}{2}$ (D) $\left(\frac{\sqrt{3}-\sqrt{2}}{2}\right)$

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**102.** If $\frac{\cos^{-1}x}{a} + \frac{\cos^{-1}y}{b} = \alpha$, prove that $\frac{x^2}{a^2} - 2\frac{xy}{ab}\cos\alpha + \frac{y^2}{b^2} = \sin^2\alpha$

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**103.** Let $\cos^{-1}\left(\frac{x}{a}\right) + \cos^{-1}\left(\frac{y}{b}\right) = \alpha$ Given equation represents and ellipse if (A) $\alpha = 0$ (B) $\alpha = \frac{\pi}{4}$ (C) $\alpha = \frac{\pi}{2}$ (D) $\alpha = \pi$

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**104.** Express: $\cot^{-1}\left(\frac{y}{(1-x^2-y^2)}\right) = 2\tan^{-1}\sqrt{\frac{3-4x^2}{4x^2}} - \frac{\tan^{-1}\sqrt{3-4x^2}}{x^2}$ as a rational integral equation in x and y.

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**105.** 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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**106.** If $(\sin^{-1}x)^2 + (\sin^{-1}y)^2 + (\sin^{-1}z)^2 = \frac{3\pi^2}{4}$, then find the minimum value of $x + y + z$

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**107.** Prove the following: $\tan\left[\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right] + \tan\left[\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right] = \frac{2b}{a}$

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**108.** If $\sum_{i=1}^{200} \sin^{-1} x_i = 100\pi, then \sum_{i=1}^{200} x_i^2$ is equal to

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**109.** Greatest value of $(\sin^{-1} x)^3 + (\cos^{-1} x)^3 is \frac{m}{n} \pi^3$, where m and n are relatively prime, then the value of mn is

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**110.** Find the value of $\cos(2\cos^{-1} x + \sin^{-1} x)$ 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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**111.** 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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**112.** Evaluate: (i) $\tan\left(2\frac{\tan^{-1}1}{5}-\frac{\pi}{4}\right)$ (ii) $\tan\left\{\frac{1}{2}\frac{\cos^{-1}\left(\sqrt{5}\right)}{3}\right\}$

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**113.** The principal value of $\sin^{-1}\left(s\in\frac{2\pi}{3}\right)$ is $-\frac{2\pi}{3}$ (b) $\frac{2\pi}{3}$ $\frac{4\pi}{3}$ (d) $\frac{5\pi}{3}$

(e) none of these

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

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

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

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**117.** If $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-..\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}\right)=\frac{\pi}{2}$ for

`0<|x|

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**118.** Prove that $\cos \tan^{-1} \sin \cot^{-1} x = \sqrt{\frac{x^2+1}{x^2+2}}$

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**119.** The domain of definition of the function $f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$ for real-valued $x$ is $\left[-\frac{1}{4}, \frac{1}{2}\right]$ (b) $\left[-\frac{1}{2}, \frac{1}{2}\right]$ (c) $\left(-\frac{1}{2}, \frac{1}{9}\right)$ (d) $\left[-\frac{1}{4}, \frac{1}{4}\right]$

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**120.** about to only mathematics

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**121.** The sum of the roots of the equation $\tan^{-1}(x+3) - \tan^{-1}(x-3) = \sin^{-1}\frac{3}{5}$ is

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**122.**

Let $f(\theta)=\sin\left(\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4}<\theta<\frac{\pi}{4}$. Then th

is -

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**123.** If $\cot^{-1}(\sqrt{\cos\alpha})-\tan^{-1}(\sqrt{\cos\alpha})=x$, 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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**124.** The trigonometric equation $\sin^{-1}x=2\sin^{-1}a$ has a solution for

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**125.** If $\cos^{-1}x - \cos^{-1}.\frac{y}{2} = \alpha$, then $4x^2 - 4xy\cos\alpha + y^2$ is equal to

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**126.** If $\sin^{-1}\left(\frac{x}{5}\right) + \cos ec^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$ then a value of x is: (1) 1 (2) 3 (3) 4 (4) 5

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**127.** The value of $\cot\left(\cos ec^{-1}\frac{5}{3} + \frac{\tan^{-1}2}{3}\right)$ is: (1) $\frac{6}{17}$ (2) $\frac{3}{17}$ (2) $\frac{4}{17}$ (4) $\frac{5}{17}$

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