

MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

INVERSE CIRCULAR FUNCTIONS - FOR COMPETITION

Solved Examples

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



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2. $3\tan^{-1}\left(\frac{1}{2}\right) + 2\tan^{-1}\left(\frac{1}{5}\right) + \sin^{-1}\left(\frac{142}{65\sqrt{5}}\right)$



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3. Find the value of $\cos[\cos^{-1} x + \sin^{-1} x]$ at $x = 1/5$



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



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



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6.

Prove

that:

$$\tan^{-1}\left(\frac{a_1x - y}{x + a_1y}\right) + \tan^{-1}\left(\frac{a_2 - a_1}{1 + a_1a_1}\right) + \tan^{-1}\left(\frac{a_3 - a_2}{1 + a_3a_2}\right) + \dots + \tan^{-1}\left(\frac{a_n - a_{n-1}}{1 + a_na_{n-1}}\right) = \frac{\pi}{2}$$



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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: $\cos^{-1}x_0 = \left(\frac{\sqrt{1-x_0^2}}{x_1x_2x_3\dots \rightarrow \infty} \right)$ where the successive quantities x_r are connected by the relation $x_{r+1} = \sqrt{\frac{1+x_r}{2}}$



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9. If a, b are positive quantities and if $a_1 = \frac{a+b}{2}, b_1 = \sqrt{ab}, a_2 = \frac{a_1+b_1}{2}, b_2 = \sqrt{a_2b_1}$ and so on show that $Lt_{n \rightarrow \infty} a_n = Lt_{n \rightarrow \infty} b_n = \frac{\sqrt{b^2 - a^2}}{\cos^{-1}\left(\frac{a}{b}\right)}$



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10.

Prove

that

$$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) + \dots + \tan^{-1}\left(\frac{1}{n^2+n+1}\right)$$



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11. If $x_1, x_2, x_3, \text{ and } x_4$ 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

$$\tan^{-1} x_1 + \tan^{-1} x_2 + \tan^{-1} x_3 + \tan^{-1} x_4 = n\pi + \left(\frac{\pi}{2}\right) - \beta, \text{ where } n$$

is an integer.



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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

$$\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi \text{ prove that } x^4 + y^4 + z^4 + 4x^2y^2z^2 = 2(x^2y^2 + y^2z^2 + z^2x^2)$$



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14. Find all possible values of p and q for which

$$\cos^{-1} \sqrt{p} + \cos^{-1} \sqrt{1-p} + \cos^{-1} \sqrt{1-q} = \frac{3\pi}{4}$$



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15. Find the number of positive integral solutions of

$$\tan^{-1} x + \cot^{-1} y = \tan^{-1} 3.$$



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$$16. \frac{\sin^{-1}(ax)}{c} + \frac{\sin^{-1}(bx)}{c} = \sin^{-1} x \text{ where } a^2 + b^2 = c^2 \text{ and } c \neq 0$$



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17. Convert the trigonometric function $\sin[2\cos^{-1}\{\cot(2\tan^{-1}x)\}]$ into an algebraic function $f(x)$. Then from the algebraic function find 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 θ 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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19. If $0 < x < 1$, then $\sqrt{1+x^2}\left[\{x\cos(\cot^{-1}x) + \sin(\cot^{-1}x)\}^2 - 1\right]^{\frac{1}{2}}$ is equal to



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

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21.

If

$$\sin^{-1}\left(x - \frac{x^2}{2} + \frac{x^3}{4} - \dots\right) + \cos^{-1}\left(x^2 - \frac{x^4}{2} + \frac{x^6}{4} - \dots\right) = \frac{\pi}{2}$$

for $0 < |x| < \sqrt{2}$ then $x =$

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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
zero b. one c. two d.

infinite

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

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24. The value of x satisfying $\sin^{-1} x + \sin^{-1}(1-x) = \cos^1 x$ are

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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.
 $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}, \forall x \in R$ (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 explanation 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 $\sin^{-1} x = \cos^{-1} x$, then $x = \frac{1}{\sqrt{2}}$, 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 explanation 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 $\cos(\cos^{-1} x + \sin^{-1}(x - 2))$ is equal to (A) 0 (B) 1 (C) -1 (D) $\sqrt{1 - x^2} \cdot \sqrt{x^2 - 4x + 3} + x(x - 2)$



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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) $\left(\sqrt{3} + \frac{\sqrt{8}}{6}\right)$ (B) $\frac{1+2\sqrt{6}}{6}$ (C) $-\frac{1+2\sqrt{6}}{6}$ (D) 0



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30. If $f(x) = e^{\cos \cos^{-1}x^2 + \tan \cot^{-1}x^2}$, then minimum value of $f(x)$ is (A) e
(B) e^2 (C) $e^{\frac{2}{3}}$ (D) none of these



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



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32. If $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin \theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$, then the value of $\frac{d}{d(\tan \theta)} f(\theta)$ 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. Find the value of : $\cos^{-1}\cos\left(\frac{5\pi}{4}\right)$



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



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



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



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9.

Show

that:

$$\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 = 2 \left(\tan^{-1} 1 + \tan^{-1} \left(\frac{1}{2} \right) + \tan^{-1} \left(\frac{1}{3} \right) \right)$$



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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

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



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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:

$$\tan \left\{ \tan^{-1} \left(\frac{d}{1 + a_1 a_2} \right) + \tan^{-1} \left(\frac{d}{1 + a_2 a_3} \right) + \tan^{-1} \left(\frac{d}{1 + a_3 a_4} \right) + \dots \right\}$$



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



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14. If $\tan^{-1} y = 5 \tan^{-1} x$ express as an algebraic function of x and hence show that $\tan 18^\circ$ is a root of the equation $5u^4 - 10u^2 + 1 = 0$



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15.

Prove

that:

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



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16.

Show

taht

$$2 \tan^{-1} \left(\tan\left(\frac{\alpha}{2}\right) \tan\left(\frac{\pi}{4} - \frac{\beta}{2}\right) \right) = \tan^{-1} \left(\frac{\sin \alpha \cos \beta}{\cos \alpha + \sin \beta} \right)$$



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17.

If

$$\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi,$$

Prove

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



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18.

Express:

$$\cot^{-1} \left(\frac{y}{\sqrt{1-x^2-y^2}} \right) = 2 \tan^{-1} \sqrt{\frac{3-4x^2}{4x^2}} - \tan^{-1} \sqrt{\frac{3-4x^2}{x^2}} \text{ as}$$

a rational integral equation in x and y.



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19. If $m \frac{\tan(\alpha - \theta)}{\cos^2 \theta} = n \frac{\tan \theta}{\cos^2(\alpha - \theta)}$ the prove that
 $2\theta = \alpha - \left[\tan^{-1} \left(\frac{n-m}{n+m} \right) \tan \alpha \right]$

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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
 $b^2 x^2 + 2xy\sqrt{a^2 b^2 - c^2} = c^4 - a^2 y^2 - 2x^2 y^2$

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

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22. $\cos^{-1} \sqrt{\frac{a-x}{a-b}} = \sin^{-1} \sqrt{\frac{x-b}{a-b}}$ 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. $\frac{\sin^{-1}(3x)}{5} + \frac{\sin^{-1}(4x)}{5} = \sin^{-1} x$, then roots of the equation are-

- a. 0 b. 1 c. -1 d. -2



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



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



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30. if $\phi = \tan^{-1}\left(\frac{x\sqrt{3}}{2k-x}\right)$ and $\theta = \tan^{-1}\left(\frac{2x-k}{k\sqrt{3}}\right)$ then one of the value of $\phi - \theta$ 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: $\sin^{-1} \left(\frac{x}{\sqrt{1+x^2}} \right) - \sin \left(\frac{1}{\sqrt{1+x^2}} \right) = \sin^{-1} \left(\frac{1+x}{1+x^2} \right)$



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34. If $\tan^{-1} x, \tan^{-1} y$ and $\tan^{-1} z$ are in A.P. then find the algebraic relation between x, y and z . If x, y, z are also in A.P. then show that $x = y = z$ and $y \neq 0$



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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 to infinite terms the series:

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



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



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38. Find the number of solution of the equation

$$|y| = \sin x \text{ and } y = \cos^{-1} \cos x \text{ where } -2\pi \leq x \leq 2\pi$$



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



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40. Find the integral values of K for which the system of equations
 $\left[\arccos x + (\arcsin y)^2 = k \frac{\pi^2}{4}; (\arccos x)(\arcsin y)^2 = \frac{\pi^2}{16} \right]$
possesses solutions & find those solutions.



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41. Which of the following identities does not hold? (A)
 $\sin^{-1} x = \cot^{-1} \left[\frac{\sqrt{(1-x^2)}}{x} \right], 0 < x \leq 1$ (B)
 $\sin^{-1} x = \cot^{-1} \left[\frac{\sqrt{(1-x^2)}}{x} \right], -1, = x < 0$ (C)

$$\sin^{-1} x = \cos^{-1} \sqrt{1 - x^2}, 0 < x \leq 1 \quad (\text{D})$$

$$\sin^{-1} x = 1 - \sin^{-1}(-x), -1 \leq x \leq 1$$



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42.

Solve

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



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43. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, then (A) $x^2 + y^2 = z^2$ (B)

$x^2 + y^2 + z^2 = 0$ (C) $x^2 + y^2 + z^2 = 1$ (D) none of these



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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 α, β, γ 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) $4 + \frac{\sqrt{5}}{9}$ (B) $4\sqrt{2} + \frac{\sqrt{5}}{9}$ (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
a. $\frac{1}{\sqrt{5}}$ b. $\frac{2}{\sqrt{5}}$ c. $\frac{\sqrt{3}}{2}$



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49. The solution of $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$ is
(A) $\frac{1}{6}$ (B) 1 (C) $\left\{ \frac{1}{6}, 1 \right\}$
(D) none of these



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50.

$\tan^{-1} \left(\frac{1}{3} \right) + \tan^{-1} \left(\frac{1}{7} \right) + \tan^{-1} \left(\frac{1}{13} \right) + \dots + \tan^{-1} \left(\frac{1}{1+n+n^2} \right) +$
is equal to (A) $\frac{2\pi}{3}$ (B) 0 (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{4}$



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51. If $\cos^{-1} \left(\frac{x}{2} \right) + \cos^{-1} \left(\frac{y}{3} \right) = \theta$, then $(x^2 - 12xy \cos \theta + 4y^2) =$
(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. $\sin^{-1}(2x\sqrt{1-x^2}) = 2\sin^{-1}x$ is true if- $x \in [0, 1]$ b.

$$\left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right] \text{ c. } \left[-\frac{1}{2}, \frac{1}{2} \right] \text{ d. } \left[-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2} \right]$$



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



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57. If we consider only the principal value of the inverse trigonometric

functions then the value of $\tan\left(\cos^{-1}\left(\frac{1}{\sqrt{2}}\right) - \sin^{-1}\left(\frac{4}{\sqrt{17}}\right)\right)$ is (A)

- (A) $\frac{\sqrt{29}}{3}$ (B) $\frac{29}{3}$ (C) $\frac{\sqrt{3}}{29}$ (D) $-\frac{3}{5}$



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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 $x = \sin(2 \tan^{-1} 2)$, $y = \sin\left(\frac{1}{2} \tan^{-1}\left(\frac{4}{3}\right)\right)$, then -

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60. The set of values of a for which $x^2 + ax + \sin^{-1}(x^2 - 4x + 5) + \cos^{-1}(x^2 - 4x + 5) = 0$ has at least one solution is (A) $(-\infty, -\sqrt{2\pi}] \cup [\sqrt{(2\pi, \infty)}$ (B) $(-\infty, -\sqrt{2\pi}] \cup [\sqrt{(2\pi, \infty)}$ (C) R (D) none of these

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61.

If

$$\tan^{-1}(x + h) = \tan^{-1}(x) + (h \sin y)(\sin y) - (h \sin y)^2 \cdot \frac{\sin^2 y}{2} + (h \sin y)$$

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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62. Solution set of $[\sin^{-1} x] > [\cos^{-1} x]$. where $[\cdot]$ denotes greatest integer function



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



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64.

If

$$\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2} \text{ and } f(1) = 2, f(p+q) = f(p) \cdot f(q) \forall p, q \in \mathbb{R}$$

then $x^{f(1)} + y^{f(2)} + z^{f(3)} - \frac{x+y+z}{x^{f(1)} + y^{f(2)} + z^{f(3)}}$ is equal to



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

$x = -1$ (D) $x \in \phi$



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66. Solve the equation: $\tan^{-1} \sqrt{x^2 + x} + \sin^{-1} \sqrt{x^2 + x + 1} = \frac{\pi}{2}$



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67. Solution set of inequation $(\cos^{-1} x)^2 - (\sin^{-1} x)^2 > 0$ is (A)

(B) $\left[-1, \frac{1}{\sqrt{2}} \right)$ (C) $(-1, \sqrt{2})$ (D) none of these



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



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



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



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



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$$72. \cos^{-1} \left\{ -\sin \left(\frac{5\pi}{6} \right) \right\} = \text{(A)} -\frac{5\pi}{6} \text{(B)} \frac{5\pi}{6} \text{(C)} \frac{2\pi}{3} \text{(D)} -\frac{2\pi}{3}$$



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

these



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$$74. \sin^{-1} \left(-\frac{1}{2} \right) + \tan^{-1} (\sqrt{3}) = \text{(A)} -\frac{\pi}{6} \text{(B)} \frac{\pi}{3} \text{(C)} \frac{\pi}{6} \text{(D)} \text{ none of}$$

these



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75. $\sum_{i=1}^{2n} \sin^{-1}(x_i) = n\pi$ then the value of

$$\sum_{i=1}^n \cos^{-1} x_i + \sum_{i=1}^n \tan^{-1} x_i = \text{(A)} \frac{n\pi}{4} \text{ (B)} \left(\frac{2}{3}\right)n\pi \text{ (C)} \left(\frac{5}{4}\right)n\pi \text{ (D)}$$

$2n\pi$



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

which is greater.



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77. if $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is (A) 1 (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$



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78. If the mapping $f(x) = ax + b, a > 0$ maps $[-1, 1]$ on $\rightarrow [0, 2]$ then $[\cot^{-1} 7 + \cot^{-1} 8 + \cot^{-1} 18] =$ (A) $f(1)$ (B) $f(0)$ (C) $f(2)$ (D) $f(-1)$



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79. If $e^{\log_2 [\sin^2 \alpha + \sin^4 \alpha + \sin^6 \alpha + \dots \rightarrow \infty]}$ 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 (A) α (B) 2α (C) $-\alpha$ (D) -2α



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80. If $2\tan^{-1}x + \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is independent of 'x' then
(a) $x \in (-1, 1)$ (b) $x \in (-\infty, -1)$ (c) $x \in [1, \infty)$ (d) $x \in (0, 1)$



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81. The value of $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3$ is (A) 0 (B) 1 (C) π (D) $-\pi$



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$$82. \tan\left(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right) + \frac{7}{17} = 0$$



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



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84. The value of $\cos(2\cos^{-1}x + \sin^{-1}x)$ at $x = \frac{1}{5}$ is (A) 1 (B) 3 (C) 0 (D) $-\frac{2\sqrt{6}}{5}$



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

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86. If α, β and γ 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
 $\gamma = \cos^{-1}\left(\frac{1}{3}\right)$, then

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87. If $0 < x < 1$, then $\tan^{-1}\left(\frac{\sqrt{1-x^2}}{1+x}\right)$ is equal to (A) $\frac{1}{2}\cos^{-1}x$ (B)
 $\cos^{-1}\left(\frac{\sqrt{1+x}}{2}\right)$ (C) $\cos^{-1}\left(\sqrt{1+x}\frac{0}{4}\right)$ (D) $\frac{1}{2}\tan^{-1}\left(\frac{\sqrt{1+x}}{1-x}\right)$

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88. The value of $\cos\left[\frac{1}{2}\cos^{-1}\cos\left(\frac{14}{3}\right)\right]$ is (b) $\cos\left(-\frac{7\pi}{5}\right)$
 $\frac{\sin \pi}{10}$ (d) $-\frac{\cos(3\pi)}{5}$

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89. 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)
 $\frac{2x}{1-x^2}$, if $0 \leq x < 1$ (B) $\frac{2x}{1-x^2}$, if $x < 1$ (C) not defined if
 $x \geq 1$ (D) 0 if $-1 \leq x < 0$

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90. $\sum_{n=1}^{\infty} \left(\tan^{-1}\left(\frac{4n}{n^4 - 2n^2 + 2}\right) \right)$ is equal to (A) $\tan^{-1}(2) + \tan^{-1}(3)$
(B) $4\tan^{-1}(1)$ (C) $\frac{\pi}{2}$ (D) $\sec^{-1}(-\sqrt{2})$

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



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92. 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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93. $2 \cot^{-1} 7 + \cos^{-1}\left(\frac{3}{5}\right)$ 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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94. $\sin^{-1} x > \cos^{-1} x$ holds for (A) all of value of x (B) $x \in (0, 1/\sqrt{2})$ (C) $x \in (1/\sqrt{2}, 1)$ (D) $x = 0.75$



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95. Statement 1.

$$\cos ec^{-1}\left(\frac{3}{2}\right) + \cos^{-1}\left(\frac{2}{3}\right) - 2\cos^{-1}\left(\frac{1}{7}\right) - \cot^{-1} 7 = \cot^{-1} 7$$

- Statement 2.

$$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}, \tan^{-1} x = \cot^{-1} x = \frac{\pi}{2} \cos ec^{-1} x = \sin^{-1}\left(\frac{1}{x}\right),$$

- (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 explanation 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 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. $\{x \cos(\cot^{-1} x) + \sin(\cot^{-1} x)\}^2 = \frac{51}{50}$, 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 explanation 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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97. Statement 1. $\cos ec^{-1} \left(\frac{1}{2} + \frac{1}{\sqrt{2}} \right) > \sec^{-1} \left(\frac{1}{2} + \frac{1}{\sqrt{2}} \right)$, Statement

2. $\cosec^{-1} x > \sec^{-1} x$ if $1 \leq x < \sqrt{2}$ (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 explanation 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.

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

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

- (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 explanation 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.

Statement

1.

If

the

mapping

$$f(x) = x + b, a > 0 \text{ maps } [-1, 1] \text{ on } \rightarrow [0, 2], \text{ then } f(x) = 1 + x$$

- , Statement 2. $\cot(\cot^{-1} 7 + \cot^{-1} 8 + \cot^{-1} 18) = 3`$ (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 explanation 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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100.

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

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

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

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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101.

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

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

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

$\sin \cot^{-1} \tan \cos^{-1}(\sin \gamma)$ 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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102. $Let \alpha = \tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right),$

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

$$\gamma = \sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right) + \frac{1}{2}\cos^{-1}\left(\cos\left(\frac{2\pi}{3}\right)\right) \cos \alpha + \cos \beta + \cos \gamma \text{ is equal to}$$

(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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103. Let $\cos^{-1}\left(\frac{x}{a}\right) + \cos^{-1}\left(\frac{y}{b}\right) = \alpha$ then Answer the following

questions (A) $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{2xy}{ab} \cos \alpha = \sin^2 \alpha$ (B)

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{2xy}{ab} \cos \alpha = \sin^2 \alpha$$
 (C) $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{2xy}{ab} \cos \alpha = \sin^2 \alpha$ (D)

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{2xy}{ab} \cos \alpha = \sin^2 \alpha$$



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104. 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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105. Express:

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



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



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108. 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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109. 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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110. 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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111. Find the integral values of K for which the system of equations

$$\left[\arccos x + (\arcsin y)^2 = k \frac{\pi^2}{4}; (\arccos x)(\arcsin y)^2 = \frac{\pi^2}{16} \right]$$

possesses solutions & find those solutions.



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112. 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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113. The value of $\tan\left[\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{2}{3}\right)\right]$ is (a) $\frac{6}{17}$ (b) $\frac{7}{16}$ (c) $\frac{16}{7}$

(d) none of these



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114. Evaluate: $\tan\left\{2\tan - 1\frac{1}{5} - \frac{\pi}{4}\right\}$



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115. The principal value of $\sin^{-1}\left(s \in \frac{2\pi}{3}\right)$ 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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116. If $A = 2\tan^{-1}(2\sqrt{2} - 1)$ and $B = 3\sin^{-1}\left(\frac{1}{3}\right) + \sin^{-1}\left(\frac{3}{5}\right)$,

then which is greater.



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117. If we consider only the principal values then the value inverse trigonometric functions then the value of $\left(\cos^{-1}\left(\frac{1}{5\sqrt{2}}(-\sin^{-1})\frac{4}{\sqrt{17}}\right)\right)$ is (a) $\frac{\sqrt{29}}{3}$ (b) $\frac{29}{3}$ (c) $\frac{\sqrt{3}}{29}$ (d) $\frac{3}{29}$



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



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



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121. The domain of definition of the function $f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$ for real-valued x is (a) $\left[-\frac{1}{4}, \frac{1}{2}\right]$ (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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122. If $0 < x < 1$, then

$\sqrt{1+x^2} \left[\{x \cos(\cot^{-1} x) + \sin(\cot^{-1} x)\}^2 - 1 \right]^{\frac{1}{2}}$ is equal to



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123. The value of x satisfying

$\tan^{-1}(x+3) - \tan^{-1}(x-3) = \sin^{-1}\left(\frac{3}{5}\right)$ are (A) -4 (B) 0 (C) 4 (D) 5



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124. If $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin \theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$, then the value of $\frac{d}{d(\tan \theta)} f(\theta)$ is

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125. $\cot^{-1}\left[(\cot \alpha)^{\frac{1}{2}}\right] + \tan^{-1}\left[(\cot \alpha)^{\frac{1}{2}}\right] = x$ then $\sin x =$ (A) 1 (B) $\cot^2\left(\frac{\alpha}{2}\right)$ (C) $\tan \alpha$ (D) $\cot(\alpha/2)$

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

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127. If $\cos^{-1} x - \cos^{-1}\left(\frac{y}{2}\right) = \alpha$, then $4x^2 - 4xy \cos \alpha + y^2$ is equal to
(A) 4 (B) $2 \sin 2\alpha$ (C) $-4 \sin^2 \alpha$ (D) $4 \sin^2 \alpha$



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128. 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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129. 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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