



India's Number 1 Education App

MATHS

BOOKS - ARIHANT MATHS

INVERSE TRIGONOMETRIC FUNCTIONS

Examples

1. Find the value of

$$\tan \left[\cos^{-1} \left(\frac{1}{2} \right) + \tan^{-1} \left(-\frac{1}{\sqrt{3}} \right) \right]$$

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

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

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

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

Answer: C



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2. Find the value of

$$\cos \left[\cos^{-1} \left(\frac{-\sqrt{3}}{2} \right) + \frac{\pi}{6} \right]$$



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3. Find domain of $\sin^{-1}(2x^2 - 1)$

A. $\Rightarrow x \in [-1, 1]$

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

C. $\Rightarrow x \in [-1, 0]$

D. $\Rightarrow x \in [-2, 0]$

Answer: A



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4. Evaluate the following: $\sin^{-1}(\sin \pi/4)$



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5. Evaluate the following (i) $\sin^{-1}(\sin 7)$ (ii) $\sin^{-1}(\sin(-5))$



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6. Find the value of $\cos ec\left\{\cot\left(\cot^{-1}\cdot \frac{3\pi}{4}\right)\right\}$



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7. Prove that: $\sec^2\left(\tan^{-1}\sqrt{3}\right) + \operatorname{cosec}^2\left(\cot^{-1}\sqrt{3}\right) = 8.$



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8. Find the value of $\cos^{-1} \left\{ \sin \left(-\frac{\pi}{2} \right) \right\}$

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9. Evaluate the following

$$(i) \sin^{-1} \left(\sin \left(\frac{-3\pi}{4} \right) \right) \quad (ii) \cot^{-1} (\cot(-4))$$

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10. Evaluate the following

$$\sin \left(\frac{\pi}{2} - \sin^{-1} \left(\frac{-1}{2} \right) \right)$$

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11. Evaluate the following

$$(i) \sin \left(\cos ec^{-1} \frac{5}{3} \right) \quad (ii) \cot \left(\tan^{-1} \cdot \frac{3}{4} \right)$$

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

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

B. $\frac{2}{3}$

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

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

Answer: D



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13. Find the value of

$$\sin(2\cos^{-1}x + \sin^{-1}x) \text{ when } x = \frac{1}{5}$$



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14. Solve $\sin^{-1}x - \cos^{-1}x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$.



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15. Prove that: $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{5}\right) = \tan^{-1}\left(\frac{7}{9}\right)$



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16. Prove that : $\tan^{-1} 2 + \tan^{-1} 3 = \frac{3\pi}{4}$



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17. Prove that

$$\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{8} = \frac{\pi}{4}$$



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18. Prove that

$$\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19} = \frac{\pi}{4}$$



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19. Prove that $\tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$



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20. Prove that $\sin^2\left(\frac{\pi}{4}\right) + \cos^2\left(\frac{\pi}{4}\right) + \cos ec^2\left(\frac{\pi}{6}\right) = 5$



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



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22. Solve for x , $\tan^{-1}(x+1) + \tan^{-1}x + \tan^{-1}(x-1) = \tan^{-1} 3x$



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23. Find the value of

$$\sin\left(\frac{\pi}{4}\right)\cos\left(\frac{\pi}{6}\right) + \cos\left(\frac{\pi}{4}\right)\sin\left(\frac{\pi}{6}\right)$$



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



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25. Solve the following equation

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



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26. Solve $\frac{\tan(45^\circ + x)}{\tan(45^\circ - x)}$



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27. 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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28. If $\sum_{i=1}^{2n} \cos^{-1} x_i = 0$, then find the value of $\sum_{i=1}^{2n} x_i$



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29. Prove that $\sin x \cos x [\tan x + \cot x] = 1$



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30. Find the value of $\frac{\tan 45^\circ - \tan 30^\circ}{1 + \tan 45^\circ \tan 30^\circ}$



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31. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, prove that

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



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32. The sum of the infinte series

$$\sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + \sin^{-1}\left(\frac{\sqrt{2}-1}{\sqrt{6}}\right) + \dots \sin^{-1}\left(\frac{\sqrt{n}-\sqrt{n-1}}{\sqrt{n(n+1)}}\right)$$



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33. Evaluate the following :

$$\sin^2\left(\tan^{-1}\left(\frac{3}{4}\right)\right)$$



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34. Evaluate: $\tan\left\{\left(2\tan^{-1}\left(\frac{1}{5}\right) - \frac{\pi}{4}\right)\right\}$ (ii) $\tan\left\{\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right\}$



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



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36. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$, show 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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37. Draw the graph of $f(x) = 4x^3 - 3x$ and hence draw the graph of $g(x) = \cos^{-1}(4x^3 - 3x)$.



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38. Prove that

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



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39. The solution of the differential equation $\frac{dy}{dx} = 1 + x + y + xy$ is



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40. Solve: $\sin[2 \cos^{-1}\{\cot(2 \tan^{-1} x)\}] = 0$



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41. Find the value of the following:

$$\frac{\tan 1}{2} \left[\sin^{-1} \left(2 \frac{x}{1+x^2} \right) + \frac{\cos^{-1}(1-y^2)}{1+y^2} \right], |x| < 1, y > 0 \quad xy < 1$$



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42. 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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43. The value of $5 \cdot \cot(\sum_{k=1}^5 \cot^{-1}(k^2 + k + 1))$ is equal to

A. $\frac{5}{2}$

B. 7

C. -7

D. $\frac{7}{2}$

Answer: B



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44. If the equation

$$5 \arctan(x^2 + x + k) + 3 \operatorname{arc cot}(x^2 + x + k) = 2\pi, \text{ has two distinct}$$

solutions, then the range of k , is

- A. $\left(0, \frac{5}{4}\right]$
- B. $\left(-\infty, \frac{5}{4}\right)$
- C. $\left(\frac{5}{4}, \infty\right)$
- D. $\left(-\infty, \frac{5}{4}\right]$

Answer: B



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45. If $f(x) = x^{11} + x^9 - x^7 + x^3 + 1$ and $f(\sin^{-1}(\sin 8)) = \alpha$, α is constant, then $f(\tan^{-1}(\tan 8))$ is equal to

- A. α
- B. $\alpha - 2$
- C. $\alpha + 2$
- D. $2 - \alpha$

Answer: D



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46. The number of values of x for which $\sin^{-1}\left(x^2 - \frac{x^4}{3} + \frac{x^6}{9}\right) + \cos^{-1}\left(x^4 - \frac{x^8}{3} + \frac{x^{12}}{9}\dots\right) = \frac{\pi}{2}$, where $0 \leq |x| < \sqrt{3}$, is _____

A. 1

B. 2

C. 3

D. 4

Answer: C



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47. Suppose $3\sin^{-1}(\log_2 x) + \cos^{-1}(\log_2 y) = \pi/2$ and $\sin^{-1}(\log_2 x) + 2\cos^{-1}(\log_2 y) = 11\pi/6$. then the value $x^{-2} + y^{-2}$ equals .

A. 6

B. 7

C. 5

D. $\frac{7}{2}$

Answer: A



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48. Find the domain and range of $f(x) = \sin^{-1}(\log[x]) + \log(\sin^{-1}[x])$, where $[\cdot]$ denotes the greatest integer function.

A. 1

B. 2

C. 0

D. $\left\{ \log_{\frac{\pi}{2}} \frac{\pi}{2} \right\}$

Answer: D



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49. $\sum_{n=1}^5 \sin^{-1}(\sin(2n - 1))$ is



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50. If α and β ($\alpha > \beta$) are roots of the equation $x^2 - \sqrt{2}x + \sqrt{3 - 2\sqrt{2}} = 0$, then the value of $(\cos^{-1} \alpha + \tan^{-1} \alpha + \tan \alpha)$ is equal to

A. $\frac{3\pi}{8}$

B. $\frac{5\pi}{8}$

C. $\frac{7\pi}{8}$

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

Answer: A



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51. 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

A. $f\left(\frac{2}{3}\right)$

B. $f\left(\frac{1}{3}\right)$

C. $f\left(\frac{-1}{3}\right)$

D. $f\left(\frac{-2}{3}\right)$

Answer: D



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52. If $(\sin^{-1} a)^2 + (\cos^{-1} b)^2 + (\sec^{-1} c)^2 + (\csc^{-1} d)^2 = \frac{5\pi^2}{2}$

then the value of

$(\sin^{-1} a)^2 - (\cos^{-1} b)^2 + (\sec^{-1} c)^2 - (\csc^{-1} d)^2$ is

A. $-\pi^2$

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

C. 0

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

Answer: C



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53.

If

$$f(x) = \sum_{r=1}^n \tan^{-1} \left(\frac{1}{x^2 + (2r-1)x + (r^2 - r + 1)} \right) , \text{ then } \left| \lim_{n \rightarrow \infty} f'(0) \right|$$

is

A. 1

B. 2

C. 3

D. 4

Answer: A



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54. The range of the function

$$f(x) = \sec^{-1}(x) + \tan^{-1}(x), \text{ is}$$

A. $(0, \pi)$

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

C. $\left(0, \frac{3\pi}{4}\right]$

D. None of these

Answer: A



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55. The solution set of inequality $(\cot^{-1} x)(\tan^{-1} x) + \left(2 - \frac{\pi}{2}\right)\cot^{-1} x - 3\tan^{-1} x - 3\left(2 - \frac{\pi}{2}\right) > 0$, is

- A. $x \in (\tan 2, \tan 3)$
- B. $x \in (\cot 3, \cot 2)$
- C. $x \in (-\infty, \tan 2) \cup (\tan 3, \infty)$
- D. $x \in (-\infty, \cot 3) \cup (\cot 2, \infty)$

Answer: B



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- 56.** Let $f(x) = \sin(\sin^{-1} 2x) + \cos ec(\cos ec^{-1} 2x) + \tan(\tan^{-1} 2x)$, then which one of the following statements is/are incorrect ?
- a. $f(x)$ is odd function
 - b. $f(x)$ is injective

c. Range of $f(x)$ contains only two integers.

d. The value of $f'\left(\frac{1}{2}\right)$ is equal to 6.

A. $f(x)$ is odd function

B. $f(x)$ is injective

C. Range of $f(x)$ contains only two integers.

D. The value of $f'\left(\frac{1}{2}\right)$ is equal to 6.

Answer: D



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57. If $f(x) = \cos^{-1}(\cos(x + 1))$ and $g(x) = \sin^{-1}(\sin(x + 2))$, then

$$f(1) + g(1) = (\pi - 1)$$

$$f(1) > g(1)$$

$$f(2) > g(2)$$

$$f(2) < g(2)$$

A. $f(1) + g(1) = (\pi - 1)$

B. $f(1) > g(1)$

C. $f(2) > g(2)$

D. $f(2) < g(2)$

Answer: A::B::C



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58. Prove that $2 \sin^2\left(\frac{\pi}{2}\right) + \cos^2\left(\frac{\pi}{3}\right) + \tan^2\left(\frac{\pi}{4}\right) = \frac{13}{4}$



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59. Prove that $\frac{\sin 4x + \sin 3x + \sin 2x}{\cos 4x + \cos 3x + \cos 2x} = \tan 3x$



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60. Which of the following is/are correct?

A.

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

B.

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

C.

$$\sum_{t=1}^{5000} \cos^{-1}(\cos(2t\pi - 1)) = \sum_{t=1}^{2500} \cot^{-1}(\cot(t\pi + 2)) , \text{ where } t \in I$$

D.

$$\cot^{-1} \cot \cos ec^{-1} \cos ec \sec^{-1} \sec \tan \tan^{-1} \cos \cos^{-1} \sin^{-1} \sin 4 = 4$$

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



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61. Let x_1 and x_2 ($x_1 > x_2$) be roots of the equation $\sin^{-1}(\cos(\tan^{-1}(\cos ec(\cot^{-1} x)))) = \frac{\pi}{6}$, then

A. $\sin^{-1} \cdot \frac{1}{x_1} + \cos^{-1} \cdot \frac{1}{x_2} = \pi$

B. $\sin^{-1}\left(\frac{1}{x_1}\right) + \cos^{-1}\left(\frac{1}{x_2}\right) = 0$

C. $\sin^{-1}\left(\frac{1}{x_1}\right) + \sin^{-1}\left(\frac{1}{x_2}\right) = 0$

D. $\cos^{-1}\left(\frac{1}{x_1}\right) + \cos^{-1}\left(\frac{1}{x_2}\right) = \pi$

Answer: A::C::D



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62. Suppose f , g and h be three real valued function defined on \mathbb{R} Let

$f(x) = 2x + |x|$ $g(x) = \frac{1}{3}(2x - |x|)$ $h(x) = f(g(x))$ The range of the function $k(x) = 1 + \frac{1}{\pi}(\cos^{-1} h(x) + \cot^{-1}(h(x)))$ is equal to

A. $\left[\frac{1}{4}, \frac{7}{4}\right]$

B. $\left[\frac{5}{4}, \frac{11}{4}\right]$

C. $\left[\frac{1}{4}, \frac{5}{4}\right]$

D. $\left[\frac{7}{4}, \frac{11}{4}\right]$

Answer: B



63. Suppose f , g , and h be three real valued function defined on \mathbb{R} .

Let $f(x) = 2x + |x|$, $g(x) = \frac{1}{3}(2x - |x|)$ and $h(x) = f(g(x))$

The domain of definition of the function $l(x) = \sin^{-1}(f(x) - g(x))$ is equal to

A. $\left(\frac{3}{8}, \infty\right]$

B. $(-\infty, 1]$

C. $[-1, 1]$

D. $\left(-\infty, \frac{3}{8}\right]$

Answer: D



64. In $\triangle ABC$, if $\angle B = \sec^{-1}\left(\frac{5}{4}\right) + \cos ec^{-1}\sqrt{5}$,
 $\angle C = \cos ec^{-1}\left(\frac{25}{7}\right) + \cot^{-1}\left(\frac{9}{13}\right)$ and $c = 3$

$\tan A, \tan B, \tan C$ are in

- A. AP
- B. GP
- C. HP
- D. neither AP, GP nor HP

Answer: A



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65. In ΔABC , if $\angle B = \sec^{-1}\left(\frac{5}{4}\right) + \cos ec^{-1}\sqrt{5}$,
 $\angle C = \cos ec^{-1}\left(\frac{25}{7}\right) + \cot^{-1}\left(\frac{9}{13}\right)$ and $c = 3$

The distance between orthocentre and centroid of triangle with sides $a^2, b^{\frac{4}{3}}$ and c is equal to

A. $\frac{5}{2}$

B. $\frac{5}{3}$

C. $\frac{10}{3}$

D. $\frac{7}{2}$

Answer: B



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66. Prove that $\sin A \sin(60^\circ - A) \sin(60^\circ + A) = \frac{1}{4} \sin 3A$



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67. Let x_1, x_2, x_3 be the solution of
 $\tan^{-1}\left(\frac{2x+1}{x+1}\right) + \tan^{-1}\left(\frac{2x-1}{x-1}\right) = 2\tan^{-1}(x+1)$

where $x_1 < x_2 < x_3$, then

$2x_1 + x_2 + x_3^2$ is equal to



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68. If the range of function

$$f(x) = (\pi\sqrt{2} + \cos^{-1}\alpha)x^2 + 2(\cos^{-1}\beta)x + \pi\sqrt{2} - \cos^{-1}\alpha \text{ is } [0, \infty)$$

then find the value of $|\alpha - \beta| + 2\alpha\beta + 1$.



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69. Consider $f(x) = \sin^{-1}[2x] + \cos^{-1}([x] - 1)$ (where $[.]$ denotes greatest integer function.) If domain of $f(x)$ is $[a, b]$ and the range of $f(x)$ is $\{c, d\}$ then $a + b + \frac{2d}{c}$ is equal to (where $c < d$)



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70.

Let

$$f(x) = \min(\tan^{-1}x, \cot^{-1}x) \text{ and } h(x) = f(x+2) - \pi/3.$$

Let $x_-(1), x_-(2)$ (where $x_1 < x_2$) be the integers in the range of $h(x)$, then the value of $(\cos^{-1}(\cos x_1) + \sin^{-1}(\sin x_2))$ is equal to



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71. If the area enclosed by the curves

$$f(x) = \cos^{-1}(\cos x) \text{ and } g(x) = \sin^{-1}(\cos x) \text{ in } x \in [9\pi/4, 15\pi/4]$$

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



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72. Consider the curve $y = \tan^{-1} x$ and a point $A\left(1, \frac{\pi}{4}\right)$ on it. If the

variable point $P_i(x_i, y_i)$ moves on the curve for

$$i = 1, 2, 3, \dots, N (n \in N) \text{ such that } y_i = \sum_{m=1}^i \tan^{-1}\left(\frac{1}{2m^2}\right) \text{ and}$$

$B(x, y)$ be the limiting position of variable point P_n as $n \rightarrow \infty$, then

the value of reciprocal of the slope of AB will be ___



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73. If $\tan^{-1} x + \tan^{-1} \frac{\sqrt{1-y^2}}{y} = \frac{\pi}{3}$ and

$$\sin^{-1} y - \cos^{-1} \left(\frac{x}{\sqrt{1+x^2}} \right) = \frac{\pi}{6}, \text{ then } \frac{5 \sin^{-1} x}{\sin^{-1} y} \text{ is}$$



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74. If $A = \frac{1}{1}\cot^{-1}\left(\frac{1}{1}\right) + \frac{1}{2}\cot^{-1}\left(\frac{1}{2}\right) + \frac{1}{3}\cot^{-1}\left(\frac{1}{3}\right)$ and $B = 1\cot^{-1}(1) + 2\cot^{-1}(2) + 3\cot^{-1}(3)$ " then " $|B - A|$ " is equal to " $(a\pi)/b + c/d \cot^{-1}(3)$ where $a, b, c, d \in \mathbb{N}$ are in their lowest form , find $(b - a - c - d)$



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75. Statement I If α, β are roots of $6x^2 + 11x + 3 = 0$, then $\cos^{-1} \alpha$ exists but not $\cot^{-1} \beta (\alpha > \beta)$.

Statement II Domain of $\cos^{-1} x$ is $[-1, 1]$.



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76. Statement I
 $\tan^{-1} x + \tan^{-1} y = \frac{\pi}{4} - \tan^{-1} z$ and $x + y + z = 1$, then arithmetic mean of odd powers of x, y, z is equal to $1/3$.

Statement II For any x, y, z we have

$$xyz - xy - yz - zx + x + y + z = 1 + (x - 1)(y - 1)(z - 1)$$



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77. Match the principal values of $\cos^{-1}(8x^4 - 8x^2 + 1)$ given in column I with the corresponding intervals of x given in column II . For which it holds .

Column I	Column II
A $4\cos^{-1}x$	p. $0 \leq x \leq \frac{1}{\sqrt{2}}$
B $4\cos^{-1}x - 2\pi$	q. $\frac{1}{\sqrt{2}} \leq x \leq 1$
C $2\pi - 4\cos^{-1}x$	r. $-1 \leq x \leq -\frac{1}{\sqrt{2}}$
D $4\pi - 4\cos^{-1}x$	s. $-\frac{1}{\sqrt{2}} \leq x \leq 0$



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



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80. If $[\sin^{-1}(\cos^{-1}(\sin^{-1}(\tan^{-1} x)))] = 1$, where $[\cdot]$ denotes the greatest integer function, then $x \in$

A. $[\tan \sin \cos 1, \tan \sin \cos \sin 1]$

B. $(\tan \sin \cos 1, \tan \sin \cos \sin 1)$

C. $[-1, 1]$

D. $[\sin \cos \tan 1, \sin \cos \sin \tan 1]$

Answer: A



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

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

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83. 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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84. 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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85. 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



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86. The set of values of k for which $x^2 - kx + \sin^{-1}(\sin 4) > 0$ for all real x is



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87. 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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88. Prove that $\frac{\cos 5x - \cos x}{\sin 5x - 2 \sin 3x + \sin x} = \cot x$



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89.

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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90. Prove that $(\sin 3x + \sin x)\sin x + (\cos 3x - \cos x)\cos x = 0$



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91. If $x = \cos ec[\tan^{-1}\{\cos(\cot^{-1}(\sec(\sin^{-1} a)))\}]$ and
 $y = \sec[\cot^{-1}\{\sin(\tan^{-1}(\cos ec(\cos^{-1} a)))\}]$ then find the relation

between x and y



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92.

Show

that

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



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93. Solve the following equation for x :

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



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94. Express the following complex number in the form $a + ib$:

$$(-2 + 3i)^3$$



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95. Solve the equations $2(\sin^{-1} x)^2 - (\sin^{-1} x) - 6 = 0$



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



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Jee Type Solved Examples Subjective Type Examples

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



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Exercise For Session 1

1. Find the value of the following

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

A. $-1/2$

B. 1

C. $1/2$

D. $1/4$

Answer: C



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2. Find the value of : $\cos ec\left[\sec^{-1}(\sqrt{2}) + \cot^{-1}(1)\right]$

A. 1

B. -2

C. 0

Answer: D



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3. Find the domain of the following

$$y = \sec^{-1}(x^2 + 3x + 1)$$

A. $(-\infty, -3] \cup [-2, -1] \cup [0, \infty)$

B. $(-\infty, -3] \cup [-2, -1]$

C. $(-\infty, -3] \cup [0, \infty)$

D. None of these

Answer: A



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4. Find the domain of the following $y = \cos^{-1}\left(\frac{x^2}{1+x^2}\right)$

- A. $[-1,1]$
- B. R
- C. $[0, 1]$
- D. $[-1, 5]$

Answer: B



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5. Find the domain of the following $y = \tan^{-1}\left(\sqrt{x^2 - 1}\right)$

a. $(-\infty, -2] \cup [1, \infty)$

b. $(-\infty, -1]$

c. $(-\infty, -1] \cup [2, \infty)$

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

A. $(-\infty, -2] \cup [1, \infty)$

B. $(-\infty, -1]$

C. $(-\infty, -1] \cup [2, \infty)$

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

Answer: D



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Exercise For Session 2

1. What is the principal value of $\cos^{-1}\left(\cos\frac{2\pi}{3}\right) + \sin^{-1}\left(\sin\frac{2\pi}{3}\right)$?

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

B. $-\pi$

C. π

D. 0

Answer: C



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

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

B. (2π)

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

D. None of these

Answer: A



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3. The value of $\sin^{-1} \left(\cos \left(\frac{33\pi}{5} \right) \right)$ is

A. $-\frac{\pi}{5}$

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

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

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

Answer: B



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4. Find the value of $\cos^{-1}(\cos 13)$.



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5. Find $\sin^{-1}(\sin \theta), \cos^{-1}(\cos \theta), \tan^{-1}(\tan \theta), \cot^{-1}(\cot \theta)$ for $\theta \in \left(\frac{5\pi}{2}, 3\pi\right)$



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Exercise For Session 3

1. Find the value of : $\cos\left\{\sin\left(\sin^{-1}\frac{\pi}{6}\right)\right\}$



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



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3. Evaluate the following :

$$\sin^2\left(\cos^{-1}\cdot\frac{1}{2}\right) + \cos^2\left(\sin^{-1}\sqrt{\frac{3}{2}}\cdot\right).$$



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4. The value of $\tan^2\left(\sec^{-1} 2\right) + \cot^2\left(\operatorname{cosec}^{-1}\frac{2}{\sqrt{3}}\right)$ is



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5. Prove that: $\cos(\cos^{-1} x) = \cos ec(\cos ec^{-1}x)$.



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Exercise For Session 4

1. Evaluate the following

$$\tan^{-1} \left\{ \tan \left(-\frac{7\pi}{8} \right) \right\}.$$



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2. Evaluate the following

$$\tan^{-1} \left\{ \cot \left(-\frac{1}{4} \right) \right\}$$



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3. Evaluate the following

$$\sec \left(\cos^{-1} \left(\frac{2}{3} \right) \right).$$



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4. Evaluate the following

$$\cos \operatorname{ec} \left(\sin^{-1} \left(\frac{\sqrt{3}}{2} \right) \right)$$



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5. Evaluate the following

$$\cos \left[\cos^{-1} \left(\frac{-1}{2} \right) - \sin^{-1} \left(\frac{1}{2} \right) \right].$$



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6. If $\sin^{-1} x = \pi/5$, for some $x \in (-1, 1)$, then find the value of $\cos^{-1} x$



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7. If $\sec^{-1} x = \cos ec^{-1} y$, then find the value of $\cos^{-1} \cdot \frac{1}{x} + \cos^{-1} \cdot \frac{1}{y}$



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8. 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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9. Solve the following

$$5 \tan^{-1} x + 3 \cot^{-1} x = 2\pi$$



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10. If $4 \sin^{-1} x + \cos^{-1} x = \pi$, then what is the value of x ?



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Exercise For Session 5

1. Show that $\sin^{-1} \frac{3}{5} + \sin^{-1} \frac{15}{17} = \pi - \sin^{-1} \frac{84}{85}$



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2. Prove that $\sin^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{5}{13}\right) + \sin^{-1}\left(\frac{16}{65}\right) = \frac{\pi}{2}$.



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3. If $\tan^{-1} 4 + \tan^{-1} 5 = \cot^{-1} \lambda$, then find ' λ '



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



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5. Solve the following

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



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6. Solve the following

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



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Exercise For Session 6

1. Evaluate the following :

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



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2. Evaluate the following :

$$\sec(\cot^{-1} 1)$$



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3. Find the value of $\sin\left(\frac{1}{2}\cot^{-1}(0)\right)$

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

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5. Show that $\cot\left[\sin^{-1}\sqrt{\frac{13}{17}}\right] = \sin\left[\tan^{-1}\cdot\frac{2}{3}\right]$

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Exercise For Session 7

1. Sketch for the curve $y = \sin^{-1}(3x - 4x^3)$

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2. Sketch the graph for $y = \tan^{-1} \left(\frac{3x - x^3}{1 - 3x^2} \right)$



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3. Draw the graph of the following

$$y = \cos^{-1}(2x^2 - 1)$$



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4. Find the value of the trigonometric function $\tan\left(\frac{3\pi}{2}\right)$



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5. Sketch the graph for $y = \tan^{-1} \left(\frac{2x}{1 - x^2} \right)$



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6. Sketch the graph for $y = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$



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7. Draw the graph of $y = \cos^{-1} \cdot \frac{1-x^2}{1+x^2}$.



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Exercise Single Option Correct Type Questions

1. Find $\cot^{-1}\left(\sqrt{\frac{1-x^2}{1+x^2}}\right)$ in terms of \cos

A. $\cos^{-1}(x^2)$

B. $\frac{\pi}{2} - \frac{1}{2}\cos^{-1}(x^2)$

C. $\frac{\pi}{3} - \frac{1}{2}\cos^{-1}(x^2)$

D. None of these

Answer: D



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2. The value of $\cos\left(\frac{1}{2}\cos^{-1}\left(\frac{1}{8}\right)\right)$ is equal to

A. $3/4$

B. $-3/4$

C. $1/16$

D. $1/4$

Answer: A



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

A. $x = 2 - \sqrt{9 - 2\pi}$

B. $x = 2 + \sqrt{9 - 2\pi}$

C. $x \in (2 - \sqrt{9 - 2\pi}, 2 + \sqrt{9 - 2\pi})$

D. $x > 2 + \sqrt{9 - 2\pi}$

Answer: C



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4. The value of

$$\sin^{-1} \left\{ \left(\sin. \frac{\pi}{3} \right) \frac{x}{\sqrt{(x^2 + k^2 - kx)}} \right\} - \cos^{-1} \left\{ \left(\cos. \frac{\pi}{6} \right) \frac{x}{\sqrt{(x^2 + k^2 - kx)}} \right\}$$

is

A. $\tan^{-1} \left(\frac{2x^2 + sk - k^2}{x^2 - 2xk + k^2} \right)$

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

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

D. None of the above

Answer: D



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

A. $\left(0, \frac{\pi}{4}\right)$

B. $\left(0, \frac{\pi}{2}\right)$

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

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

Answer: A



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6. Sum of infinite terms of the series

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

A. $\pi/4$

B. $\tan^{-1} 2$

C. $\tan^{-1} 3$

D. $\tan^{-1} 4$

Answer: B



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7. Solution of equation $\cot^{-1} x + \sin^{-1} \frac{1}{\sqrt{5}} = \frac{\pi}{4}$ is

A. $x = 3$

B. $x = 1/\sqrt{5}$

C. $x = 0$

D. None of these

Answer: A



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8. Solution set of the inequality

$$(\cot^{-1} x)^2 - (5 \cot^{-1} x) + 6 > 0 \text{ is}$$

- A. $(\cot 3, \cot 2)$
- B. $(-\infty, \cot 3) \cup (\cot 2, \infty)$
- C. $(\cot 2, \infty)$
- D. None of the above

Answer: B



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9. Find the sum to infinite terms of the series

$$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{2}{9}\right) + \dots + \tan^{-1}\left(\frac{2^{n-1}}{1+2^{2n-1}}\right) + \dots$$

A. $\pi/4$

B. $\pi/2$

C. π

D. None of these

Answer: A



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10. If $x + \frac{1}{x} = 2$, the principal value of $\sin^{-1} x$ is

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

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

C. π

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

Answer: B



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11. If $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, then the value of $\tan^{-1}\left(\frac{\tan x}{4}\right) + \tan^{-1}\left(\frac{3 \sin 2x}{5 + 3 \cos 2x}\right)$ is

A. $x/2$

B. $2x$

C. $3x$

D. x

Answer: D



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

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

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

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

D. π

Answer: B



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13. The value of $\frac{\cot(\pi)}{4} - 2 \cot^{-1}(3)$ is

A. 1

B. 7

C. -1

D. None of these

Answer: B



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14. $\sin\left[\tan^{-1}\cdot\frac{1-x^2}{2x} + \cos^{-1}\cdot\frac{1-x^2}{1+x^2}\right]$ is

A. 1

B. 0

C. -1

D. None of these

Answer: A



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15. If $\cos^{-1}\left(\frac{1-a^2}{1+a^2}\right) - \cos^{-1}\left(\frac{1-b^2}{1+b^2}\right) = 2\tan^{-1}x$, then x is

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

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

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

D. None of these

Answer: A



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

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

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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17. The value of

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

A. 0

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

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

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

Answer: D



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18. If $\frac{\tan^{-1}(x)}{\pi} < \frac{\pi}{3}x \in N$ then the maximum value of x is

A. 2

B. 5

C. 7

D. None of these

Answer: B



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19. If $\tan^{-1} \frac{\sqrt{(1+x^2)} - \sqrt{(1-x^2)}}{\sqrt{(1+x^2)} + \sqrt{(1-x^2)}} = \alpha$, then x^2 is

A. $\cos 2\alpha$

B. $\sin 2\alpha$

C. $\tan 2\alpha$

D. $\cot 2\alpha$

Answer: B



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20. Find the number of positive integral solutions of
 $\tan^{-1} x + \cot^{-1} y = \tan^{-1} 3$.

A. one

B. two

C. three

D. four

Answer: B



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21. If $\cos ec^{-1}(\cos ecx)$ and $\cos ec(\cos ec^{-1}x)$ 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. $[-1, 0) \cup (0, 1]$

Answer: A



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

A. -1

B. $\sqrt{2}$

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

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

Answer: D



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23. Complete solution set of $(\cot^{-1} x) + 2(\tan^{-1} x) = 0$, where $[]$

denotes the greatest integer function, is equal to

A. $(0, \cot 1)$

B. $(0, \tan 1)$

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

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

Answer: D



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24. Prove that $\sin 7x + \sin 5x + \sin 3x + \sin x = 4 \cos x \cos 2x \sin 4x$



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

Answer: D



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26. The number of integer x satisfying

$$\sin^{-1}|x - 2| + \cos^{-1}(1 - |3 - x|) = \frac{\pi}{2} \text{ is}$$

A. 1

B. 2

C. 3

D. 4

Answer: B



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27. 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

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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28. Prove that $\frac{\cos^3 x - \sin^3 x}{\cos x - \sin x} = \frac{2 + \sin 2x}{2}$



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

A. $-\pi$

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

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

D. π

Answer: A



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30. Let $u = \cot^{-1} \sqrt{\cos 2\theta} - \tan^{-1} \sqrt{\cos 2\theta}$, then the value of $\sin u$ is

A. $\cos 2\theta$

B. $\sin 2\theta$

C. $\tan^2 \theta$

D. $\cot^2 \theta$

Answer: C



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31.

Let

$$f(x) = \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right) = 2 \tan^{-1} x x \geq 0, = -2 \tan^{-1} x x > 0$$

function $f(x)$ is continuous everywhere but not differentiable at x equals to

A. 1

B. -1

C. 0

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

Answer: C



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32. Let $f(x) = \sin^{-1} \left(\frac{2x}{1+x^2} \right) \forall x \in R$. The function $f(x)$ is

continuous everywhere but not differentiable at x is/ are

A. 0, 1

B. -1, 1

C. $-1, 0$

D. $0, 2$

Answer: B



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33. Let $f: R \setminus \frac{\pi}{2} \rightarrow$ be defined by $f(x) = \tan^{-1}(x^2 + x + a)$. Then the set of values of a for which f is onto is (a) $(0, \infty)$ (b) $[2, 1]$ (c) $\left[\frac{1}{4}\right]$ (d) $\left[\frac{1}{4}, \infty\right]$



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34. Let $f(x) = \sin^{-1} 2x + \cos^{-1} 2x + \sec^{-1} 2x$. Then the sum of the maximum and minimum values of $f(x)$ is

(a) π

(b) $\frac{\pi}{2}$

(c) 2π

(d) $\frac{3\pi}{2}$

A. π

B. 2π

C. 3π

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

Answer: B



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35. If $\tan^{-1} \cdot \frac{b}{c+a} + \tan^{-1} \cdot \frac{c}{a+b} = \frac{\pi}{4}$ where a, b, c , are the sides of ΔABC , then ΔABC is

A. Acute - angled triangle

B. Obtuse - angled triangle

C. Right- angled triangle

D. Equilateral triangle

Answer: C



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36. Solutions of $\sin^{-1}(\sin x) = \sin x$ are if $x \in (0, 2\pi)$

A. 4 real roots

B. 2 positive real roots

C. 2 negative real roots

D. 5 real roots

Answer: D



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37. The equation $\frac{e^{\sin^{-1} x}}{\pi} = \frac{y}{\log y}$ has

A. Unique solution

B. Infinite many solution

C. $x = 1$

D. $y = e$

Answer: B



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38. Let $f(x) = 1 + 2 \sin\left(\frac{e^x}{e^x + 1}\right)$ $x \geq 0$ then $f^{-1}(x)$ is equal to

(assuming f is bijective)

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

B. $\log\left(\frac{\sin\left(\frac{x-1}{2}\right)}{1 - \sin\left(\frac{x-1}{2}\right)}\right)$

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

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

Answer: A



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39. $\cos^{-1}(\cos(2 \cot^{-1}(\sqrt{2} - 1)))$ 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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40. The maximum value of $f(x) = \tan^{-1} \left(\frac{(\sqrt{12} - 2)x^2}{x^4 + 2x^2 + 3} \right)$ is

A. 18°

B. 36°

C. 22.5°

D. 15°

Answer: D



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41. If $\frac{\tan^{-1}(\sqrt{1+x^2}-1)}{x} = 4^0$ 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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42. If $\tan^{-1}(\sin^2 \theta - 2 \sin \theta + 3) + \cot^{-1}(5^{\sec^{-1}(2y)} + 1) = \frac{\pi}{2}$, then value of $\cos^2 \theta - \sin \theta$ is equal to

A. 0

B. -1

C. 1

D. None of the above

Answer: C



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43. The number of solution of the equation $|\tan^{-1}|x|| = \sqrt{(x^2 + 1)^2 - 4x^2}$ is

A. 1

B. 2

C. 3

D. 4

Answer: D



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44. For any real number $x \geq 1$, the expression

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

A. 1

B. 2

C. $2x^2$

D. $2\sqrt{2}$

Answer: B



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45. Let $f: R \rightarrow [0, \frac{\pi}{2})$ be defined by $f(x) = \tan^{-1}(x^2 + x + a)$. Then set of value of a for which $f(x)$ is onto is

A. 1

B. 2

C. 3

D. 4

Answer: C



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46. The value of expression

$$\tan^{-1}\left(\frac{\sqrt{2}}{2}\right) + \sin^{-1}\left(\frac{\sqrt{5}}{5}\right) - \cos^{-1}\left(\frac{\sqrt{10}}{10}\right)$$

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

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

C. $-\pi + \cot^{-1}\left(\frac{1 + \sqrt{2}}{1 - \sqrt{2}}\right)$

$$D. \pi - \cot^{-1} \left(\frac{1 - \sqrt{2}}{1 + \sqrt{2}} \right)$$

Answer: C



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47. The value of $\sec \left(2 \cot^{-1} 2 + \cos^{-1} \cdot \frac{3}{5} \right)$ is equal to

A. $\frac{25}{24}$

B. $-\frac{24}{7}$

C. $\frac{25}{7}$

D. $-\frac{25}{7}$

Answer: D



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48. Which one of the following statement is meaningless ?

A. $\cos^{-1} \left(\ln \left(\frac{2e+4}{3} \right) \right)$

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

C. $\cot^{-1} \left(\frac{\pi}{2} \right)$

D. $\sec^{-1}(\pi)$

Answer: A



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

A. $\sec \frac{10\pi}{9}$

B. $\sec \frac{\pi}{9}$

C. 1

D. -1

Answer: B



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50. The number k is such that $\tan\{\arctan(2) + \arctan(20k)\} = k$. The sum of all possible values of k is

A. $-\frac{19}{40}$

B. $-\frac{21}{40}$

C. 0

D. $\frac{1}{5}$

Answer: A



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51. The value of $\sum_{r=1}^{\infty} \tan^{-1}\left(\frac{1}{r^2 - 5r + 7}\right)$, is

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

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

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

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

Answer: C



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52.

If

$$x = \tan^{-1} 1 - \cos^{-1}\left(-\frac{1}{2}\right) + \frac{\sin^{-1} 1}{2}, y = \cos\left(\frac{1}{2}\cos^{-1}\left(\frac{1}{8}\right)\right),$$

then

A. $x = \pi y$

B. $y = \pi x$

C. $\tan x = -(4/3)y$

D. $\tan x = (4/3)y$

Answer: C



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53. Prove that:

$$\tan^{-1}\left(\frac{1}{2}\tan 2A\right) + \tan^{-1}(\cot A) + \tan^{-1}(\cot^3 A) = 0$$



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54. Prove that : $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{8}\right) = \frac{\pi}{4}$

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

B. $4\tan^{-1} 1$

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

D. $\sec^{-1}(-\sqrt{2})$

Answer: A



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55. Number of solutions (s) of the equations

$$\cos^{-1}(1-x) - 2\cos^{-1}x = \frac{\pi}{2} \text{ is}$$

A. 3

B. 2

C. 1

D. 0

Answer: C



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

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

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

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

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

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

Answer: C



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57. The range of values of p for which the equation $\sin \cos^{-1}(\cos(\tan^{-1} x)) = p$ 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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58. Number of solutions of the equation

$$\log_{10} \left(\sqrt{5 \cos^{-1} x - 1} \right) + \frac{1}{2} \log_{10} (2 \cos^{-1} x + 3) + \log_{10} \sqrt{5} = 1 \text{ is}$$

- A. 0
- B. 1
- C. more than one but finite
- D. infinite

Answer: B



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



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60. The set of values of x, satisfying the equation $\tan^2(\sin^{-1} x) > 1$ is -

A. $[-1, 1]$

B. $\left[-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right]$

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

D. $[-1, 1] - \left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right)$

Answer: C



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61. The solution set of equation

$$\sin^{-1} \sqrt{1-x^2} + \cos^{-1} x = \cot^{-1} \left(\frac{\sqrt{1-x^2}}{x} \right) - \sin^{-1} x, \text{ is}$$

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

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

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

D. $[-1, 1]$

Answer: C



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62. The value of the angle $\tan^{-1}(\tan 65^\circ - 2\tan 40^\circ)$ in degrees is equal to

A. -20°

B. 20°

C. 25°

D. 40°

Answer: C



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63. Prove that $\cot x - 2\cot 2x = \tan x$



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64. The value of $\sum_{r=1}^{\infty} \tan^{-1} \left(\frac{1}{r^2 + 5r + 7} \right)$ is equal to

A. $\tan^{-1} 3$

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

C. $\frac{\pi}{2} - \cos^{-1} \cdot \frac{1}{\sqrt{10}}$

D. $\cot^{-1} 2$

Answer: C



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65. The range of the function ,

$$f(x) = \tan^{-1} \left(\frac{1+x}{1-x} \right) - \tan^{-1} x \text{ is}$$

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

B. $\{-(\pi/4), 3\pi/4\}$

C. $\{\pi/4, -(\pi/4)\}$

D. $\{3\pi/4\}$

Answer: C



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66. Let $g: \overrightarrow{R} \setminus \frac{\pi}{3}$ be defined by $g(x) = \cos^{-1}\left(\frac{x^2 - k}{1 + x^2}\right)$. Then find the possible values of k for which g is a subjective function.

A. $\left\{ \frac{1}{2} \right\}$

B. $\left(-1, -\frac{1}{2} \right]$

C. $\left\{ -\frac{1}{2} \right\}$

D. $\left[-\frac{1}{2}, 1 \right)$

Answer: C



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67. Number of values of x satisfying simultaneously
 $\sin^{-1} x = 2 \tan^{-1} x$ and $\tan^{-1} \sqrt{x(x-1)} + \cos ec^{-1} \sqrt{1+x-x^2} = \frac{7}{2}$, is

A. 0

B. 1

C. 2

D. 3

Answer: C



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68. Number of values of x satisfying the equation
 $\cos(3 \arccos(x-1)) = 0$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: D



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69. Which one of the following function contains only one integer in its range ?

[Note $\text{sgn}(k)$ denotes the signum function of k .]

A. a. $f(x) = \frac{1}{2} \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right)$

B. b. $g(x) = \text{sgn} \left(x + \frac{1}{x} \right)$

C. c. $h(x) = \sin^2 x + 2 \sin x + 2$

D. d. $k(x) = \cos^{-1} (x^2 - 2x + 2)$

Answer: D



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70. If range of the function $f(x) = \tan^{-1}(3x^2 + bx + 3)$, $x \in R$ is $\left[0, \frac{\pi}{2}\right)$, then square of sum of all possible values of b will be

A. 6

B. 18

C. 72

D. None of these

Answer: A



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Exercise More Than One Correct Option Type Questions

1. Let $\theta = \tan^{-1}\left(\tan. \frac{5\pi}{4}\right)$ and $\phi = \tan^{-1}\left(-\tan. \frac{2\pi}{3}\right)$ then

A. $\theta > \phi$

B. $4\theta - 3\phi = 0$

C. $\theta + \phi = \frac{7\pi}{12}$

D. None of these

Answer: B::C



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2. Let $f(x) = e^{\cos^{-1}((-1))} \left\{ \sin\left(x + \frac{\pi}{3}\right) \right\}$. Then, $f\left(\frac{8\pi}{9}\right) = e^{5\pi/18}$ (b)

$e^{13\pi/18}$ (c) $e^{-2\pi/18}$ (d) none of these

A. $f\left(\frac{8\pi}{9}\right) = e^{5\pi/18}$

B. $f\left(\frac{8\pi}{9}\right) = e^{13\pi/18}$

C. $f\left(-\frac{7\pi}{4}\right) = e^{\pi/12}$

D. $f\left(-\frac{7\pi}{4}\right) = e^{11\pi/12}$

Answer: B::C



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3. 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

A. $a + b = 23$

B. $a - b = 11$

C. $3b = a + 1$

D. $2a = 3b$

Answer: A::B::C



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4. Let $f(x) = \sin^{-1} x + \cos^{-1} x$. Then $\frac{\pi}{2}$ is equal to

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

B. $f(k^2 - 2k + 3), k \in R$

C. $f\left(\frac{1}{1+k^2}\right)$, $k \in R$

D. $f(-2)$

Answer: A::C



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5. $\cos^{-1} x = \tan^{-1} x$ then

A. $x^2 = \frac{\sqrt{5}-1}{2}$

B. $x^2 = \frac{\sqrt{5}+1}{2}$

C. $\sin(\cos^{-1} x) = \frac{\sqrt{5}-1}{2}$

D. $\tan(\cos^{-1} x) = \frac{\sqrt{5}-1}{2}$

Answer: A::C



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6. The solution of $\sin^{-1}|\sin x| = \sqrt{\sin^{-1}|\sin x|}$ is

- (a) $n\pi - 1$ (b) $n\pi$
(c) $n\pi + 1$ (d) $2n\pi + 1$

A. $n\pi - 1$

B. $n\pi$

C. $n\pi + 1$

D. $2n\pi + 1$

Answer: A::B::C



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7. Find the value of trigonometric function $\tan\left(\frac{22\pi}{3}\right)$



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8. 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. $\sin|\sin^{-1} x| = |x|$

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



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

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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10. $\sin^{-1}(\sin 3) + \sin^{-1}(\sin 4) + \sin^{-1}(\sin 5)$ when simplified reduces to

- A. an odd number
- B. a rational number
- C. an even prime
- D. a negative integer

Answer: B::D



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11. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, then

find $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z$

A.

B.

C.

D.

Answer: A::B



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12. $2\tan(\tan^{-1}(x) + \tan^{-1}(x^3))$, where $x \in R - \{-1, 1\}$, is equal to

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

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

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

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

Answer: A::B::C



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13. Let $f(x) = \sin^{-1}|\sin x| + \cos^{-1}(\cos x)$. Which of the following statement(s) is / are TRUE ?

A. $f(f(3)) = \pi$

B. $f(x)$ is periodic with fundamental period 2π

C. $f(x)$ is neither even nor odd

D. Range of $f(x)$ is $[0, 2\pi]$

Answer: A::B



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14. If $f(x) = \sin^{-1}x \cdot \cos^{-1}x \cdot \tan^{-1}x \cdot \cot^{-1}x \cdot \sec^{-1}x \cdot \csc^{-1}x$, then which of the following statement (s) hold(s) good?

- A. (a) The graph of $y = f(x)$ does not lie above x -axis
- B. (b) The non-negative difference between the maximum and the minimum value of the function $y = f(x)$ is $\frac{3\pi^6}{64}$
- C. (c) The function $y = f(x)$ is not injective.
- D. (d) Number of non-negative integers in the domain of $f(x)$ is 2.

Answer: A::B



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15. Prove that $\sin 2x + \sin 8x = 2 \sin 5x \cos 3x$



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16. Let function $f(x)$ be defined as

$f(x) = |\sin^{-1} x| + \cos^{-1}\left(\frac{1}{x}\right)$. Then which of the following is /are TRUE.

A. $f(x)$ is injective in its domain.

B. $f(x)$ is many - one in its domain.

C. Range of f is singleton set

D. $\operatorname{sgn}(f(x)) = 1$, where $\operatorname{sgn} x$ denotes signum function of x .

Answer: A::D



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17. Which of the following pairs of function are identical?

A. $f(x) = \sin(\tan^{-1} x)$, $g(x) = \frac{x}{\sqrt{1+x^2}}$

B. $f(x) = \operatorname{sgn}(\cot^{-1} x)$, $g(x) = \sec^2 x - \tan^2 x$, where $\operatorname{sgn} x$

denotes signum function of x .

C. $f(x) = e^{\ln \left(\cos^{-1} \left(\frac{x^2-1}{x^2+1} \right) \right)}$, $g(x) = \cos^{-1} \left(\frac{x^2-1}{x^2+1} \right)$

D. $f(x) = \sin^{-1} \left(\frac{2x}{1+x^2} \right)$, $g(x) = 2 \tan^{-1} x$

Answer: A::C



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18. The value of $\sum_{n=1}^{\infty} \cot^{-1}(n^2 + n + 1)$ is also equal to



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19. Find the multiplicative inverse of the complex number $7 + 3i$



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20. If $\log x = \frac{-1}{3}$, and Find $\log(\sin(\arccos \sqrt{1 - x^2}))$

A. a. $P = \frac{-1}{9}$

B. b. $P + Q = \frac{-4}{15}$

C. c. $P - Q = \frac{-2}{5}$

D. d. $\frac{P}{Q} = -5$

Answer: B::C::D



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Exercise Statement I And II Type Questions

1. Prove that $\cot 4x(\sin 5x + \sin 3x) = 2 \cos 4x \cos x$



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2. Let S denotes the set consisting of four functions and $S = \{[x], \sin^{-1} x, |x|, \{x\}\}$ where , $\{x\}$ denotes fractional part and $[x]$ denotes greatest integer function , Let A, B , C are subsets of S.

Suppose

A : consists of odd functions (s)

B : consists of discontinuous function (s)

and C: consists of non-decreasing function(s) or increasing function (s).

If $f(x) \in A \cap C, g(x) \in B \cap C, h(x) \in B$ but not C and $l(x) \in$

neither A nor B nor C .

Then, answer the following.

The range of function $f(x)$ is

- A. $\{-1, 0, 1\}$
- B. $\{-1, 0\}$
- C. $\{0, 1\}$
- D. $\{-2, -1, 0, 1\}$

Answer: D



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3. Prove that $\frac{\sin 17x - \sin 3x}{\cos 9x - \cos 5x} = -\frac{\cos 10x}{\sin 2x}$



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4. Let f be a real - valued function defined on \mathbb{R} (the set of real numbers)

such that $f(x) = \sin^{-1}(\sin x) + \cos^{-1}(\cos x)$

The value of $f(10)$ is equal to

A. $6\pi - 20$

B. $7\pi - 20$

C. $20 - 7\pi$

D. $20 - 6\pi$

Answer: B



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5. Let f be a real - valued function defined on \mathbb{R} (the set of real numbers)

such that $f(x) = \sin^{-1}(\sin x) + \cos^{-1}(\cos x)$

The area bounded by curve $y = f(x)$ and x- axis from $\frac{\pi}{2} \leq x \leq \pi$ is

equal to

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

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

C. π^2

D. $\frac{\pi^2}{8}$

Answer: B



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6. Let f be a real - valued function defined on R (the set of real numbers)

such that $f(x) = \sin^{-1}(\sin x) + \cos^{-1}(\cos x)$

Number of values of x in interval $(0, 3)$ so that $f(x)$ is an integer, is equal to

A. 1

B. 2

C. 3

D. 0

Answer: C



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7. Consider a real-valued function $f(x) = \sqrt{\sin^{-1} x + 2} + \sqrt{1 - \sin^{-1} x}$

then The domain of definition of $f(x)$ is

A. $[-1, 1]$

B. $[\sin 1, 1]$

C. $[-1, \sin 1]$

D. $[-1, 0]$

Answer: C



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8. Consider a real - valued function

$$f(x) = \sqrt{\sin^{-1} x + 2} + \sqrt{1 - \sin^{-1} x}$$

The range of $f(x)$ is

A. $[0, \sqrt{3}]$

B. $[1, \sqrt{2}]$

C. $[1, \sqrt{6}]$

D. $[\sqrt{3}, \sqrt{6}]$

Answer: D



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9. Find the value of other five trigonometric functions if $\cos x = 5/9$, x lies in fourth quadrant



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

A. $\left(\frac{1}{3}, \infty\right)$

B. $(-1, \infty)$

C. $(-\infty, m - 1)$

D. None of these

Answer: A



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

A. 1

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

C. -1

D. None of these

Answer: C



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12. 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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13. 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 $\cos^{-1}(\cos 5t^2)$ 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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14. 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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Exercise Passage Based Questions

1. Let $f(x) = \tan^{-1}\left(\frac{(x-2)}{x^2+2x+2}\right)$, then $26f'(1)$ is



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2. Let $f(x) = (\arctan x)^3 + (\operatorname{arc\cot} x)^3$. If the range of $f(x)$ is $[a, b]$, then find the value of $\frac{b}{7a}$.



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3. If $\sum_{n=0}^{\infty} 2 \cot^{-1}\left(\frac{n^2+n+4}{2}\right) = k\pi$, then find the value of k .



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4. Find the number of solution of the equation

$$\tan\left(\sum_{r=1}^5 \cot^{-1}(2r^2)\right) = \frac{5x+6}{6x+5}.$$



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5.

$$\lim_{z \rightarrow 0} \left[\left\{ \max (\sin^{-1} x + \cos^{-1} x)^2, \min (x^2 + 4x + 7) \right\} \right] \cdot \frac{\sin^{-1} z}{z}$$

is equal to (where [.] denotes greatest integer function)



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6.

If

$$\sin(30^\circ + \arctan x) = \frac{13}{14} \text{ and } 0 < x < 1, \text{ the value of } x \text{ is } \frac{a\sqrt{3}}{b}$$

, where a and b are positive integers with no common factors . Find the value of $\left(\frac{a+b}{2}\right)$.



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7. Let $f: R \rightarrow \left(0, \frac{2\pi}{3}\right]$ defined as $f(x) = \cot^{-1}(x^2 - 4x + \alpha)$ Then the smallest integral value of α such that, $f(x)$ is into function is



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8. Let L denotes the number of subjective functions $f: A \rightarrow B$, where set A contains 4 elements and set B contains 3 elements. M denotes number of elements in the range of the function $f(x) = \sec^{-1}(sgnx) + \cos ec^{-1}(sgnx)$ where $sgnx$ denotes signum function of x. And N denotes coefficient of t^5 in $(1+t^2)^5(1+t^3)^8$. The value of $(LM + N)$ is λ , then the value of $\frac{\lambda}{19}$ is



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9. Number of solution (s) of the equations $\cos^{-1}(\cos x) = x^2$ is



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10. Prove that $\frac{\sin x - \sin 3x}{\cos^2 x - \sin^2 x} = -2 \sin x$



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11. Let $f(x) = \cos(\tan^{-1}(\sin(\cot^{-1} x)))$. The simplest form of $f(x)$ can be written as $\left(\frac{x^2 + A}{x^2 + B}\right)^{1/2}$. Then the value of $(A + B)$ is

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12. Prove that :

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

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13. The least natural number 'n' for which

$$(n-2)x^2 + 8x + n + 4 > \sin^{-1}(\sin 12) + \cos^{-1}(\cos 12) \quad \forall x \in R$$
 is

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14. The least value of n for which

$$(n-2)x^2 + 8x + n + 4 > \sin^{-1}(\sin 12) + \cos^{-1}(\cos 12), \quad \forall x \in R, \text{ where}$$

, is



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15. Solve the equation $(\sin x + \cos x)^{1+\sin 2x} = 2$, when $-\pi \leq x \leq \pi$.



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Exercise Matching Type Questions

1. Prove that $\frac{\cos 5x + \cos 3x}{\sin 5x + \sin 3x} = \cot 4x$



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2. Statement I $\sin^{-1}\left(\frac{1}{\sqrt{e}}\right) > \tan^{-1}\left(\frac{1}{\sqrt{\pi}}\right)$

Statement II $\sin^{-1} x > \tan^{-1} y$ for $x > y, \forall x, y \in (0, 1)$

- A. Statement I is True, Statement II is True, Statement II is a correct explanation for statement I
- B. Statement I is True, Statement II is True, Statement II is NOT a correct explanation for Statement I
- C. Statement I is True, Statement II is False
- D. Statement I is False, Statement II is True.

Answer: A



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3. 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 $\cos ec^{-1} x > \sec^{-1} x$, if $1 \leq x < \sqrt{2}$

- A. Statement I is True, Statement II is True, Statement II is a correct explanation for statement I

B. Statement I is True, Statement II is True, Statement II is NOT a

correct explanation for Statement I

C. Statement I is True, Statement II is False

D. Statement I is False, Statement II is True.

Answer: A



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4. Let $f(x) = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ Statement I $f'(2) = -\frac{2}{5}$ and

Statement II $\sin^{-1}\left(\frac{2x}{1+x^2}\right) = \pi - 2\tan^{-1}x, \forall x > 1$

A. Statement I is True, Statement II is True, Statement II is a correct

explanation for statement I

B. Statement I is True, Statement II is True, Statement II is NOT a

correct explanation for Statement I

C. Statement I is True, Statement II is False

D. Statement I is False, Statement II is True.

Answer: A



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5. Statement I $\sin^{-1} 2x + \sin^{-1} 3x = \frac{\pi}{3}$

$$\Rightarrow x = \sqrt{\frac{3}{76}} \text{ only.}$$

and

Statement II Sum of two negative angles cannot be positive.

A. Statement I is True, Statement II is True, Statement II is a correct

explanation for statement I

B. Statement I is True, Statement II is True, Statement II is NOT a

correct explanation for Statement I

C. Statement I is True, Statement II is False

D. Statement I is False, Statement II is True.

Answer: A



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6. Statement I Number of roots of the equation $\cot^{-1} x + \cos^{-1} 2x + \pi = 0$ is zero.

Statement II Range of $\cot^{-1} x$ and $\cos^{-1} x$ is $(0, \pi)$ and $[0, \pi]$, respectively.

- A. Statement I is True, Statement II is True, Statement II is a correct explanation for statement I
- B. Statement I is True, Statement II is True, Statement II is NOT a correct explanation for Statement I
- C. Statement I is True, Statement II is False
- D. Statement I is False, Statement II is True.

Answer: A



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Exercise 6

1. Prove that $\frac{\cos x + \cos y}{\sin x - \sin y} = \cot\left(\frac{x - y}{2}\right)$



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Exercise Single Integer Answer Type Questions

1. Prove that $\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x = 1$



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Exercise Subjective Type Questions

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



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2. 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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3. Let a, b and c be positive real numbers. Then prove that

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



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4. Find the sum

$$\cos ec^{-1}\sqrt{10} + \cos ec^{-1}\sqrt{50} + \cos ec^{-1}\sqrt{170} + \dots + \cos ec^{-1}\sqrt{(n^2 + 1)}$$



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5. If $\sin^{-1} x_i \in [0, 1] \forall i = 1, 2, 3, .28$ then find the maximum value of

$$\sqrt{\sin^{-1} x_1} \sqrt{\cos^{-1} x_2} + \sqrt{\sin^{-1} x_2} \sqrt{\cos^{-1} x_3} + \\ \sqrt{\sin^{-1} x_3} \sqrt{\cos^{-1} x_4} + \dots + \sqrt{\sin^{-1} x_{28}} \sqrt{\cos^{-1} x_1}$$



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



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7. Find the value

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



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8. 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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9. If the quadratic equation ,

$4^{\sec^2 \alpha} x^2 + 2x + \left(\beta^2 - \beta + \frac{1}{2} \right) = 0$ have real roots, then find all the possible value of $\cos \alpha + \cos^{-1} \beta$.

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Exercise 7

1. Prove that : $\tan^{-1} \left(e^{i\theta} \right) = \frac{n\pi}{2} + \frac{\pi}{4} + \frac{i}{2} \ln \tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)$, where n is an integer.

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1. 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 options (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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2. Prove that $\sin^4 x + \cos^4 x = 1 - 2\sin^2 x \cos^2 x$



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3. 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

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: A



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4. 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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5. 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 $y \neq 0$

A. $x = y = z$

B. $2x = 3y = 6z$

C. $6x = 3y = 2z$

D. $6x = 4y = 3z$

Answer: A



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6. The value of $\sec\left(2\cot^{-1}2 + \cos^{-1}\frac{3}{5}\right)$ is equal to

A. $\frac{5}{17}$

B. $\frac{6}{17}$

C. $\frac{3}{17}$

D. $\frac{4}{17}$

Answer: B



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7. If $\sin^{-1}\left(\frac{x}{5}\right) + \cos^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then the value of x is

A. 1

B. 3

C. 4

D. 5

Answer: B



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8. 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 $\sin^2 \alpha$

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

B. 4 $\sin^2 \alpha$

C. 4

D. 2 $\sin 2\alpha$

Answer: B



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