MATHS

BOOKS - SHARAM PUBLICATION

INVERSE TRIGNOMETRIC FUNCTIONS

Example

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

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

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

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4. Fill in the blank choosing correct answer from the brackets if the value of $\sin^{-1}x = \frac{\pi}{5}$ for some $x \in (-1, 1)$then the value of $\cos^{-1}xis\_\_\_$.

$\left(\frac{3\pi}{10}, \frac{5\pi}{10}, \frac{7\pi}{10}\right)$

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5. Fill in the blank choosing correct answer from the brackets the value of $\tan^{-1}\left(2\frac{\cos\pi}{x}\right)is\_\_\_\_$

$\left(1, \frac{\pi}{4}, \frac{\pi}{3}\right)$

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6. Fill in the blank choosing correct answer from the brackets The value of $\cot^{-1} 2 + \frac{\tan^{-1} 1}{3} =$_ _ _ _ _.(pi/4,1,pi/2)`

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7. If x+y=4, xy=1 then what is the value of $\tan^{-1} x + \tan^{-1} y$?

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8. Fill in the blank choosing correct answer from the brackets if $\sin^{-1} \frac{x}{5} + \text{cosec}^{-1} \frac{5}{4} = \frac{\pi}{2}$, then the value of x=_____

(2,3,4)

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9. Fill in the blank choosing correct answer from the brackets The value of $\sin\left(\tan^{-1} x + \frac{\tan^{-1} 1}{x}, x > 0\right.$_ _ _.

$\left(0, 1, \frac{1}{2}\right)$

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

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11. Find the value of $\sin\left[\cot^{-1}\left\{\tan\left(\cos^{-1} x\right)\right\}\right]$

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

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13. If $\tan^{-1}x + \tan^{-1}y = \frac{\pi}{4}, xy < 1,$

then write the value of $x + y + xy.$

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

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15. Write the value of $\cos^{-1}\left(-\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right).$

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16. Write the principal value of $\tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right].$

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17. Write the principal value of $\cos^{-1}(\cos 680^\circ)$.

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18. Write the principal value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}\left(-\frac{1}{2}\right)$.

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19. Write the value of $\tan^{-1}\left(\frac{a}{b}\right) - \tan^{-1}\left(\frac{a-b}{a+b}\right)$.

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20. Evaluate $\tan^{-1}(1) + \cos^{-1}\left(\frac{-1}{2}\right)$.

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21. Write the value of $\tan^{-1}\left[2\sin\left(2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)\right]$

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22. Write the principal value of $\tan^{-1}(\sqrt{3}) - \cot^{-1}(-\sqrt{3})$.

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23. Find the value of $\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$.

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24. Write the principal value of $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\cos\left(-\frac{\pi}{2}\right)$

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25. If x+y+z=xyz, then what is the value of $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z$?

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

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27. if xy+yz+zx=1 then what is $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z$?

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28. Write the domain of the function defined by f(x)=$\sin^{-1} x + \cos x$

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29. What is the value of $\sin 2 \sin^{-1}\left(\frac{3}{5}\right)$?

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30. Find the value of $\tan\left(\frac{\pi}{4} + 2\cot^{-1}\sqrt{3}\right)$

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31. Express the value of $\operatorname{cosec}\left(\cos^{-1}\frac{3}{5} + \cos^{-1}\frac{4}{5}\right)$ in simplest form.

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32. Write the value of $\sin\cos^{-1}\tan\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ in simplest form.

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33. Find the value of $\sin\left[\cot^{-1}\left\{\tan\left(\cos^{-1}x\right)\right\}\right]$

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34. If $\sin^{-1}\frac{2a}{1+a^2} - \cos^{-1}\frac{1-b^2}{1+b^2} = \tan^{-1}\frac{2x}{1-x^2}$, then prove that $x = \frac{a-b}{1+ab}$.

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35. What is the value of $2\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right)$?

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36. Express the value of $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\frac{(x-y)}{(x+y)}$ in simplest form.

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37. What is the principal value of

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

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38. What is the principal value of $\tan^{-1}(0)$ and $\tan^{-1}(-1)$

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39. Find the principal value of :$\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$.

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40. Using the principal value, evaluate $\tan^{-1}(1)+\sin^{-1}\left(-\frac{1}{2}\right)$.

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41. write the principal value of $\sin^{-1}\left[\sin\left(\frac{3\pi}{5}\right)\right]$.

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42. If $\tan^{-1}(\sqrt{3}) + \cot^{-1}x = \frac{\pi}{2}$, then find x.

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43. Using the principal values, find the value of $\cos^{-1}\cos\left(\frac{13\pi}{6}\right)$.

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44. Show that $\sin^{-1}\frac{4}{5} + 2\tan^{-1}\frac{1}{3} = \frac{\pi}{2}$.

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45. Prove the following statements

$$\cot^{-1}9 + \operatorname{cosec}^{-1}\frac{\sqrt{41}}{4} = \frac{\pi}{4}$$

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46. Find the value of $\tan\left(\cos^{-1}\left(\frac{4}{5}\right)+\tan^{-1}\left(\frac{2}{3}\right)\right)$.

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47. Show that $\sin^{-1}\left(\frac{1}{\sqrt{10}}\right)+\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)=\frac{\pi}{4}$.

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48. Prove statement$\tan^2\cos^{-1}\frac{1}{\sqrt{3}}+\cot^2\sin^{-1}\frac{1}{\sqrt{5}}=6$

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49. Solve: $\sin^{-1}\left(\frac{2a}{1+a^2}\right)+\sin^{-1}\left(\frac{2b}{1+b^2}\right)=2\tan^{-1}x$.

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50. Prove that: $\sec^2\left(\tan^{-1}3\right) - \cos ec^2\left(\cot^{-1}3\right) = 0$

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51. Evaluate $\cos\left(2\cos^{-1}x + \sin^{-1}x\right)$ at $x = \frac{1}{5}$, where $0 \leq \cos^{-1}x \leq \pi$ and $-\frac{\pi}{2} \leq \sin^{-1}x \leq \frac{\pi}{2}$.

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52. Prove that $\tan^{-1}\sqrt{x} = \frac{1}{2}\cos^{-1}\left(\frac{1-x}{1+x}\right), x \in (0, 1).$

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53. Prove that: $\cos^{-1}\left(\frac{12}{13}\right) + \sin^{-1}\left(\frac{3}{5}\right) = \sin^{-1}\left(\frac{56}{65}\right)$

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54. Prove that: $\tan^{-1} x + \tan^{-1}\left(\frac{2x}{1-x^2}\right) = \tan^{-1}\left(\frac{3x - x^3}{1-3x^2}\right)$

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55. Directions (Q. Nos. 16-25) Prove the following

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

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56. Solve the following equation:

$\cos\left(\tan^{-1} x\right) = \sin\left(\cot^{-1}\frac{3}{4}\right).$

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

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58. Solve for x, $2\tan^{-1}(\cos x) = \tan^{-1}(2\text{cosec}x)$.

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

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60. Prove that $\cos^{-1}(x) + \cos^{-1}\left\{\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right\} = \frac{\pi}{3}$.

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61. Prove that: $\cot^{-1} 7 + \cot^{-1} 18 = \cot^{-1} 5$.

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62. Prove that: $\sin^{-1}\left(\frac{3}{5}\right)+\sin^{-1}\left(\frac{8}{17}\right)=\tan^{-1}\left(\frac{77}{36}\right)$.

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63. 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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64. Prove that $\tan^{-1}\left(\frac{1}{4}\right)+\tan^{-1}\left(\frac{2}{9}\right)=\frac{1}{2}\tan^{-1}\left(\frac{4}{3}\right)$.

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65. Solve equation $3\tan^{-1}\frac{1}{\left(2+\sqrt{3}\right)}-\tan^{-1}\frac{1}{x}=\tan^{-1}\frac{1}{3}$

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

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67. If $\sin^{-1}(1-x)_1 - 2\sin^{-1} x = \frac{\pi}{2}$, then find the value of x.

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

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69. Prove that $\tan\left\{\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right\} + \tan\left\{\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right\} = \frac{2b}{a}$.

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70. If $\cos^{-1}\left(\frac{x}{a}\right) = \cos^{-1}\left(\frac{y}{b}\right) = \theta$, prove that $\frac{x^2}{a^2} - \frac{2xy}{ab}\cos\theta + \frac{y^2}{b^2} = \sin^2\theta$.

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71. Solve for x $\tan^{-1}(x+2) + \tan^{-1}(x-2) = \tan^{-1}\left(\frac{8}{79}\right), x > 0$.

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72. Prove that: $\tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{3}{5}\right) - \tan^{-1}\left(\frac{8}{19}\right) = \frac{\pi}{4}$

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73. $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$,then prove that, $x^2 + y^2 + z^2 + xyz = 1$

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74. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$, show that $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$

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75. If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z - \pi$

show that x+y+z=xyz.

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

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77. Prove that :

$\tan^{-1}\sqrt{\frac{xr}{yz}} + \tan^{-1}\sqrt{\frac{yr}{yx}} + \tan^{-1}\sqrt{\frac{zr}{xy}} = \pi \text{where} r = x + y + z.$

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78. If $u = \cot^{-1}\sqrt{\cos\alpha} - \tan^{-1}\sqrt{\cos\alpha}$ then prove that $\sin\cup = \tan^2\left(\frac{\alpha}{2}\right)$.

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79. Prove the $\sin^{-1}\sqrt{\frac{x-q}{p-q}} = \cos^{-1}$sqrt((p-x)/(p-q))="cot"^(-1) sqrt((p-x)/(x-q))`

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80. Prove the $\sin^2\left(\sin^{-1}x + \sin^{-1}y + \sin^{-1}z\right)$

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

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81. Prove statement $\tan^{-1}x + \cot^{-1}(x+1) = \tan^{-1}\left(x^2 + x + 1\right)$

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82. Show that: $4\left(\cot^{-1}\left(\frac{3}{2}\right)+\operatorname{cosec}^{-1}\sqrt{26}\right)=\pi.$

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83. Show that: $\frac{\tan^{-1}(a-b)}{1+ab}+\frac{\tan^{-1}(b-c)}{1+bc}+\frac{\tan^{-1}(c-a)}{1+ca}=0.$

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84. Show that: $\frac{\tan^{-1}(a-b)}{1+ab}+\frac{\tan^{-1}(b-c)}{1+bc}+\frac{\tan^{-1}(c-a)}{1+ca}=0.$

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85. In a triangle ABC if $m\angle A=90^\circ$,

prove that $\tan\hat{}(-1)\ b/(a+b)+\frac{\tan^{-1}c}{a+b}=\frac{\pi}{4}$. where a,b,c, are sides of the triangle.

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86. If

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

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87. If $\sin^{-1}\left(\frac{x}{a}\right) + \sin^{-1}\left(\frac{y}{b}\right) = \sin^{-1}\left(\frac{c^2}{ab}\right)$,

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

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88. If

$\cos^{-1}\left(\frac{x}{y}\right) + \cos^{-1}\left(\frac{y}{3}\right) = \theta$, prove that$9x^2 - 12xy\cos\theta + 4y^2 = 36\sin^2\theta$

.

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89. In a ΔABC, if $m\angle A = 90^\circ$, prove that $\tan^{-1}\frac{b}{a+c} + \tan^{-1}\frac{c}{a+b} = \frac{\pi}{4}$, where a,b, c are sides of the triangle.

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90. Solve the following equations

$$\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{7} + \tan^{-1}x = \frac{\pi}{4}$$

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

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92. Solve:$\cot^{-1}\frac{1}{x-1} + \cot^{-1}\frac{1}{x} + \cot^{-1}\frac{1}{x+1} = \cot^{-1}\frac{1}{3x}$

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93. Differentiate $y = \tan^{-1}.\ \dfrac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}$

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94. Prove the

$$\tan\left(\tan^{-1}x+\tan^{-1}y+\tan^{-1}z\right)=\cot\left(\cot^{-1}x+\cot^{-1}y+\cot^{-1}z\right)$$

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

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96. Prove statement $\tan^{-1}x+\cot^{-1}(x+1)=\tan^{-1}\left(x^2+x+1\right)$

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97. Prove the following

$$\tan^{-1}\frac{2a-b}{b\sqrt{3}}+\tan^{-1}\frac{2b-a}{a\sqrt{3}}=\frac{\pi}{3}$$

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98. Prove the $\tan^{-1}\frac{1}{x+y}+\tan^{-1}\frac{y}{x^2=xy+1}=\tan^{-1}\frac{1}{x}$

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99. Prove statement

$$\cos^{-1}\frac{12}{13}+2\cos^{-1}\sqrt{\frac{64}{65}}+\cos^{-1}\sqrt{\frac{49}{50}}=\cos^{-1}\frac{1}{\sqrt{2}}$$

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100. Prove that :

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

` =2"tan"^(-1)(sqrt((a-b)/(a+b)) "tan" x/2)

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101. Prove that: $\tan^{-1}(x) = 2\tan^{-1}\left(\cos ec\tan^{-1}x - \tan\cot^{-1}x\right)$

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102. Prove that

$$\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right) = \frac{x}{2}, 0 < x < \frac{\pi}{2}, \text{ or } x \in \left(0, \frac{\pi}{4}\right)$$

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

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104. Solve: $2\tan^{-1}(\sin x) = \tan^{-1}(2\sec x), x \neq \frac{\pi}{2}.$

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105. Prove that $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right) = \frac{9}{4}\sin^{-1}\left(\frac{2\sqrt{2}}{3}\right)$.

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106. Solve for x,

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

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107. 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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108. Solve the following equations

$$\tan^{-1}\frac{1}{3}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{7}+\tan^{-1}x=\frac{\pi}{4}$$

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109. Prove that

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

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