MATHS

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INVERSE TRIGONOMETRIC FUNCTIONS

Exercise

1. Prove that

$$\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{2}{11}\right)=\tan^{-1}\left(\frac{3}{4}\right)$$

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

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3. find the principal value of $\tan^{-1}\left(\frac{-1}{\sqrt{3}}\right)$

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4. Show that $\tan^{-1}\left(\frac{-1}{\sqrt{3}}\right) + \sec^{-1}(-2) - \sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{3}$

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5. Determine whether the statement is true or false. Justify your answer.

$$\sin\left(\frac{5\pi}{6}\right) = \frac{1}{2} \Rightarrow \sin^{-1}\left(\frac{1}{2}\right) = \frac{5\pi}{6}$$

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6. Determine whether the statement is true or false. Justify your answer.

$$\tan\left(\frac{5\pi}{4}\right) = 1 \Rightarrow \tan^{-1} 1 = \frac{5\pi}{4}$$

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7. $\cos^{-1}\{\cos(x-\theta)\} = \ldots\ldots\ldots$

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8. Simplify : $\cos^{-1}\left\{\frac{3}{5}\cos x + \frac{4}{5}\sin x\right\}$

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9. Prove that $\tan^{-1}\left(\frac{2}{11}\right) + \tan^{-1}\left(\frac{7}{24}\right) = \tan^{-1}\left(\frac{1}{2}\right)$

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10. Prove that $\cos ec^{-1}x + \sec^{-1}x = \frac{\pi}{2}$

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

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12. Evaluate $\sec^2\left(\tan^{-1}2\right)$

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13. $\cos^{-1}\left(\frac{5}{13}\right)-\sin^{-1}\left(\frac{12}{13}\right)=\ldots\ldots\ldots$

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14. The values of $\tan^{-1}\left(\frac{a}{b}\right)-\tan^{-1}\left(\frac{a-b}{a+b}\right)$=?

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15. show that $\sin^{-1}\frac{3}{5}-\sin^{-1}\frac{8}{17}=\cos^{-1}\frac{84}{85}$

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16. If $y = \left(\tan^{-1} x\right)^2$, show that

$\left(x^2+1\right)^2 y_2 + 2x\left(x^2+1\right) y_1 = 2$.

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17. Given $x^2 = \cos 2\theta$ Write down θ using the inverse of cosine.

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18. Given $x^2 = \cos 2\theta$ Show that $\tan^{-1}\left(\frac{\cos\theta + \sin\theta}{\cos\theta - \sin\theta}\right) = \frac{\pi}{4} + \theta$

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19. Given $x^2 = \cos 2\theta$ Write $\tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right)$ in simplest form.

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20. $\tan^{-1} x + \tan^{-1}\left(\frac{1}{x}\right)$=.....

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21. $\sin^{-1}(\sin\theta)$=.....

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

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23. Show that $\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{12}{13}\right) = \cos ec^{-1}\left(\frac{65}{16}\right)$

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24. Write one branch of $\sin^{-1} x$ other than principal branch.

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25. Write the simplest form of $\sin^{-1}\left[x\sqrt{1-x} - \sqrt{x}.\sqrt{1-x^2}\right]$

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26. Prove that $\cos ec^{-1}x + \sec^{-1} x = \frac{\pi}{2}$

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27. If $\cos^{-1}(x/a) + \cos^{-1}(y/b) = \alpha$, Prove that $\frac{x^2}{a^2} - \frac{2xy}{ab}\cos\alpha + \frac{y^2}{b^2} = \sin^2\alpha$

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

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29. The value of $\cos\left[2\tan^{-1}(-7)\right]$ is :a) $\frac{49}{50}$ b) $-\frac{49}{50}$ c) $\frac{24}{25}$ d) $-\frac{24}{25}$

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

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31. $\sin^{-1}\sin x = x$ if and only if a)$x \in R$ b)$x \in \left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ c) $x \in [-1, 1]$ d)$x \in [0, \pi]$

A. $x \in R$

B. $x \in \left[\frac{-x}{2}, \frac{\pi}{2}\right]$

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

D. $x \in [0, \pi]$

Answer:

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32. Consider the function $f(x) = \sin^{-1}\left(2x\sqrt{1-x^2}\right), \frac{-1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$

Show that $f(x) = 2\sin^{-1}x$

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33. $\tan^{-1} x + \cot^{-1} x$ = _____ a)0 b)$\frac{\pi}{4}$ c)$\frac{\pi}{2}$ d)π

A. 0

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

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

D. pi

Answer:

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34. Show that $\tan^{-1}\left(\frac{1}{8}\right) + \tan^{-1}\left(\frac{1}{57}\right) = \tan^{-1}\left(\frac{1}{7}\right)$

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35. Prove that $\tan^{-1}\left(\frac{1}{8}\right) + 2\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{57}\right) = \frac{\pi}{4}$

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36. Evaluate $\cos\left(\sin^{-1}\left(\frac{-4}{5}\right)\right)$

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37. Find $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ =

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38. Prove that $\cos^{-1} x = 2\sin^{-1}\sqrt{\frac{1-x}{2}}$

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39. The principal value of $\sin^{-1}\left(\frac{-1}{2}\right)$.

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40. Solve $\cot\left(\tan^{-1}(x)+\cot^{-1}(x)\right)$

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41. Prove the following :

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

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42. Solve $2\tan^{-1}(\cos x)=\tan^{-1}(2\cos x)$

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43. Prove that $\sin^{-1}\frac{12}{13}+\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{63}{16}=\pi$

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44. Prove the following :

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

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45. prove the following

$$\tan^{-1}\frac{63}{16}=\sin^{-1}\frac{5}{13}+\cos^{-1}\frac{3}{5}$$

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46. Find the value of the following

$$\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$$

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

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48. If $\tan^{-1}\left(\frac{x-1}{x-2}\right)+\tan^{-1}\left(\frac{x+1}{x+2}\right)=\frac{\pi}{4}$. then find the value of x.

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49. Show 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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50. Choose the correct answer from the

bracket.

if $\cos^{-1}x=y$,then y is equal to

A. $-\pi\leq y\leq\pi$

B. $0\leq y\leq\pi$

C. $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$

D. $0 < y < \pi$

Answer:

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51. find the value of $\cos^{-1}\cos\left(\frac{7\pi}{3}\right)$

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52. Solve for x if,$\tan^{-1}\left(\frac{1+x}{1-x}\right) = 2\tan^{-1}x$

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53. Choose the correct answer from the

bracket.

$\cos\left(\tan^{-1} x\right), |x| < 1$ is equal to

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

B. $\frac{1}{\sqrt{1-x^2}}$

C. $\frac{x}{\sqrt{1+x^2}}$

D. $\frac{x}{\sqrt{1+x^2}}$

Answer:

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54. Prove that $\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{5}{13} = \sin^{-1}\frac{63}{65}$

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55. Choose the correct answer from the bracket $\tan^{-1}\left(\frac{1-\tan x}{1+\tan x}\right)$ equal to a) $\frac{\pi}{4} + \frac{x}{2}$ b) $\frac{\pi}{4} - x$ c) $\frac{x}{4} - \frac{x}{2}$ d) $x - \frac{\pi}{4}$

A. $\frac{\pi}{4}+\frac{x}{2}$

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

C. $\frac{x}{4}-\frac{x}{2}$

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

Answer:

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56. Express $\tan^{-1}\left(\frac{1-\sin x}{\cos x}\right)$ in the simplest form.

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57. Prove that $\tan^{-1}\left(\frac{1}{2}\right)-\tan^{-1}\left(\frac{2}{5}\right)=\tan^{-1}\left(\frac{1}{12}\right)$

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58. In which quadrants are the graph of

$\cos^{-1}(x)$ lies,$x \in [-1, 1]$

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

$\sin^{-1} x + \sin^{-1} y = \ldots\ldots\ldots$

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

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

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

D. π

Answer:

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60. if $\tan^{-1} x + \tan^{-1} y = \frac{\pi}{4}$ then prove that

$x + y + xy = 1$

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61. Find the values of the following

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

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

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63. Prove that $\sin^{-1}\left(\frac{8}{17}\right) + \sin^{-1}\left(\frac{3}{5}\right) = \cos^{-1}\left(\frac{36}{85}\right)$

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64. The principal value of $\tan^{-1}(-1)$ is

$\left[\frac{\pi}{4}, -\frac{\pi}{4}, \pi - \frac{\pi}{4}, \pi + \frac{\pi}{4}\right]$

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65. If $\tan^{-1} 2 + \tan^{-1} 3 = x$, find x in radian

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

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67. Prove : $\tan^{-1} x = \sec^{-1}\sqrt{1+x^2}$.

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68. Prove the following :

$$\tan^{-1}\sqrt{x} = \frac{1}{2}\cos^{-1}\left(\frac{1-x}{1+x}\right), x \in [0, 1]$$

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69. Show that $\tan^{-1}\left(\frac{x}{\sqrt{a^2-x^2}}\right) = \sin^{-1}\left(\frac{x}{a}\right)$

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

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71. In proving the result $3\sin^{-1}x = \sin^{-1}\left(3x - 4x^3\right)$ Substitute x=_____

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72. Prove that $3\sin^{-1}x = \sin^{-1}(3x - 4x^3), x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

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73. Within the domain of definitions prove that $\sin^{-1}(-x) = -\sin^{-1}x$

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74. $\tan^{-1}(\tan\theta) =$ _____

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75. Show that $\tan^{-1}\left(\frac{\cos\theta}{1+\sin\theta}\right)$ is independent of trigonometric functions.

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76. Prove that $2\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\frac{\pi}{4}$.

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77. If $xy<1, \tan^{-1}x+\tan^{-1}y$=..... a)$\tan^{-1}\left(\frac{x-y}{1+xy}\right)$ b)$\tan^{-1}\left(\frac{x+y}{1-xy}\right)$ c)$\frac{\tan x+\tan y}{1-\tan x\tan y}$ d)$\frac{\tan x-\tan y}{1-\tan x\tan y}$

A. $\tan^{-1}\left(\frac{x-y}{1+xy}\right)$

B. $\tan^{-1}\left(\frac{x+y}{1-xy}\right)$

C. $\frac{\tan x+\tan y}{1-\tan x.\tan y}$

D. $\frac{\tan x-\tan y}{1+\tan x.\tan y}$

Answer:

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

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79. If $A = \sin^{-1} \frac{2x}{1+x^2}$, $B = \cos^{-1} \frac{1-x^2}{1+x^2}$, $C = \tan^{-1} \frac{2x}{1-x^2}$ satisfies the condition $3A - 4B + 2C = \frac{\pi}{3}$. Find the value of x.

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80. Prove that

$$\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{2}{11}\right) = \tan^{-1}\left(\frac{3}{4}\right)$$

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81. Principal value of $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is a) $\frac{\pi}{3}$ b) $-\frac{\pi}{3}$ c) $\frac{\pi}{6}$ d) $2\frac{\pi}{3}$

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

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

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

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

Answer:

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82. If $\tan^{-1}\left(\frac{x-1}{x-2}\right)+\tan^{-1}\left(\frac{x+1}{x+2}\right)=\frac{\pi}{4}$. then find the value of x.

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83. If $xy<1, \tan^{-1}x+\tan^{-1}y$=..... a)$\tan^{-1}\left(\frac{x-y}{1+xy}\right)$ b)$\tan^{-1}\left(\frac{x+y}{1-xy}\right)$ c)$\frac{\tan x+\tan y}{1-\tan x\tan y}$ d)$\frac{\tan x-\tan y}{1-\tan x\tan y}$

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84. Prove that $2\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\tan^{-1}\left(\frac{31}{17}\right)$

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85. What is the value of $\sin^{-1}(\sin 160^\circ)$?

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86. Prove that $2\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\tan^{-1}\left(\frac{31}{17}\right)$

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87. The principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$

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88. Write the following functions in the simplest form :

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

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

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90. show that $\sin^{-1}\frac{3}{5} - \sin^{-1}\frac{8}{17} = \cos^{-1}\frac{84}{85}$

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91. If $\sin\left(\sin^{-1}\left(\frac{1}{5}\right) + \cos^{-1} x\right) = 1$, then the value of x is : a)-1 b) $\frac{2}{5}$ c) $\frac{1}{3}$ d) $\frac{1}{5}$

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92. Find the simplest form of $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)$.

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93. Find $\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$

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94. $\tan^{-1}\sqrt{3}-\cot^{-1}(-\sqrt{3})$ is equal to A)π B)$\frac{-\pi}{2}$ C)0 D)$2\sqrt{3}$

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95. 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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96. $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right) =$

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97. $\sin^{-1}(1-x) - 2\sin^{-1} x = \frac{\pi}{2}$,then find x

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