MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

TRIGONOMETRIC INVERSE CIRCULAR FUNCTIONS

Example

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

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2. Find the priencipal values of :

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

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3. Find the priencipal values of :

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

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4. Find the principal values of :

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

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5. Find the principal values of :

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

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6. Find the principal values of :

$\operatorname{cosec}^{-1}(-1)$

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7. Find the range or , general values of :

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

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8. Find the range or , general values of :

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

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9. Find the range or , general values of :

$\tan^{-1}(\sqrt{3})$

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10. Find the range or , general values of :

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

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11. Find the range or , general values of :

$\sec^{-1}(-2)$

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12. Find the range or , general values of :

$\operatorname{cosec}^{-1}(\sqrt{2})$

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13. State with arguments , in which of the following cases the inverse circular functions are undefined :

$$\operatorname{cosec}^{-1}\left(\frac{1}{2}\right), \cos^{-1}\left(-\frac{3}{2}\right), \sin^{-1}\left(\frac{1.7}{1.8}\right), \cot^{-1}(7), \sec^{-1}\left(\frac{4}{5}\right)$$

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14. Find the value of :

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

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15. Find the value of :

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

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16. Find the value of :

$$\sec \operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$$

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17. Find the value of :

$$\sin^{-1} \cos 150^{\circ}$$

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

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19. Find the value of :

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

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20. Find the value of : $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)+\tan^{-1}(\sqrt{3})$

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

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22. Express the other inverse circular functions in terms of $\tan^{-1}y(y>0)$.

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

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24. if two angles of a triangle are $\cot^{-1}\frac{1}{2}$ and $\cot^{-1}\frac{1}{3}$ then find the third angle .

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25. Prove that $\tan^{-1}\frac{4}{3}+\tan^{-1}\frac{12}{5}=\pi-\tan^{-1}\frac{56}{33}$.

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26. prove that $\tan^{-1}\frac{1}{4}+\tan^{-1}\frac{2}{9}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$.

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27. show that $\cos^{-1}\frac{4}{5}+\cot^{-1}\frac{5}{3}=\tan^{-1}\frac{27}{11}$.

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28. show that $\sin^{-1}\frac{4}{5}+\sin^{-1}\frac{5}{13}+\sin^{-1}\frac{16}{65}=\frac{\pi}{2}$

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29. prove that . $\tan^{-1}x-\tan^{-1}y=\frac{\cos^{-1}(1+xy)}{\sqrt{(1+x^2)(1+y^2)}}.$

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30. If $\sin(\alpha+\beta)=\frac{4}{5}$ and $\sin(\alpha-\beta)=\frac{5}{13}$, find the value of tan 2α

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31. prove that , $\tan^{-1}\frac{b-c}{1+bc}+\tan^{-1}\frac{c-a}{1+ca}+\tan^{-1}\frac{a-b}{1+ab}=0.$

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32. prove that , $\sin^{-1}\cos\sin^{-1}x+\cos^{-1}\sin\cos^{-1}x=\frac{\pi}{2}$

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33. prove that , $\sec^2\left(\tan^{-1}2\right) + \operatorname{cosec}^2\left(\cot^{-1}3\right) = 15.$

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34. show that , $\frac{1}{2}\tan^{-1}x = \cos^{-1}\sqrt{\frac{1+\sqrt{1+x^2}}{2\sqrt{1+x^2}}}.$

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35. prove that $\cos\tan^{-1}\sin\cot^{-1}x = \left(\frac{x^2+1}{x^2+2}\right)^{\frac{1}{2}}$

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

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37. show that, $\tan^{-1}\left(\frac{1}{\sqrt{3}}\tan\frac{x}{2}\right) = \frac{1}{2}\cos^{-1}\left(\frac{1+2\cos x}{2+\cos x}\right).$

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38. show that ,

$$\cot^{-1}\left\{\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right\} = \frac{x}{2}, 0 < x < \frac{\pi}{2}$$

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39. if $\cos^{-1}\frac{x}{a} + \cos^{-1}\frac{y}{b} = \alpha$ prove that ,

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

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40. If $\tan^{-1}\frac{yz}{xr} + \tan^{-1}\frac{zx}{yr} + \tan^{-1}\frac{xy}{zr} = \frac{\pi}{2}$, prove that ,

$x^2 + y^2 + z^2 + r^2$

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

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

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

then show that $x = y = z.$

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

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44. show that , the value of

$\tan^{-1}\left(\frac{x\cos\phi}{1-x\sin\phi}\right)-\cot^{-1}\left(\frac{\cos\phi}{x-\sin\phi}\right)$ is independent of x and find its simplfied value .

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45. if $\sec\theta - \operatorname{cosec}\theta = \frac{4}{3}$, show that ,$\theta = \frac{1}{2}\sin^{-1}\frac{3}{4}$.

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46. 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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47. solve : $\tan^{-1}2x+\tan^{-1}3x=\frac{\pi}{4}$

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48. solve : $3\tan^{-1}\frac{1}{2+\sqrt{3}}-\tan^{-1}\frac{1}{x}=\tan^{-1}\frac{1}{3}$

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49. solve : $\sin^{-1}\frac{5}{x}+\sin^{-1}\frac{12}{x}=\frac{\pi}{2}$

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50. solve : $\sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)-\sin^{-1}\left(\frac{1}{\sqrt{1+x^2}}\right)=\sin^{-1}\left(\frac{1+x}{1+x^2}\right)$

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51. solve : $\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\left(\sqrt{1+x+x^2}\right)=\frac{\pi}{2}$

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52. Solve : $\sin^{-1}x+\sin^{-1}y=\frac{2\pi}{3}$ and $\cos^{-1}x-\cos^{-1}y=\frac{\pi}{3}$.

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Exercise 4

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

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

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

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

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

Answer: B

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2. The prinicipal value of $\operatorname{cosec}^{-1}\left(-\sqrt{2}\right)$ is -

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

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

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

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

Answer: A

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3. The principal value of $\cot^{-1}\left(\frac{1}{\sqrt{3}}\right)$ is -

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

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

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

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

Answer: C

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4. The prinicipal value of $\tan^{-1}(-\sqrt{3})$ is -

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

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

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

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

Answer: D

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5. The prinicipa value of $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is -

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

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

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

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

Answer: A

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6. The general value of $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is -

A. $n\pi - (-1)^n \frac{\pi}{3}$

B. $n\pi + (-1)^n \frac{\pi}{3}$

C. $n\pi + (-1)^n \frac{\pi}{6}$

D. $n\pi$

Answer: B

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7. The general value of $\cos^{-1}(-1)$ is

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

B. $2n\pi \pm \frac{\pi}{3}$

C. $2n\pi \pm \pi$

D. $2n\pi \pm \frac{\pi}{6}$

Answer: C

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8. The general value of $\cot^{-1}\left(-\sqrt{3}\right)$ is -

A. $n\pi + \frac{5\pi}{6}$

B. $n\pi - \frac{5\pi}{6}$

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

D. $n\pi - \frac{\pi}{6}$

Answer: A

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9. If $2\tan^{-1}x = \sin^{-1}k$ then the value of k is -

A. $\dfrac{1-x^2}{1+x^2}$

B. $\dfrac{2x}{1-x^2}$

C. $\dfrac{2x}{1+x^2}$

D. $\dfrac{2x^2}{1+x^2}$

Answer: C

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10. $\tan^{-1}\dfrac{1}{2} + \tan^{-1}\dfrac{1}{3} =$

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

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

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

D. $\dfrac{\pi}{4}$

Answer: D

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11. State which of the statement is true ?

A. $\sin\cos^{-1}\tan 30^\circ$ represents an angle .

B. $\sin^{-1}\left(-\frac{1.5}{1.4}\right)$ is undefined but $\operatorname{cosec}^{-1}\left(-\frac{1.5}{1.4}\right)$ is defined .

C. $\cos^{-1}(\sqrt{2})$ is undefined

D. $\sin(\cos^{-1}x) = \cos(\sin^{-1}(\sqrt{2})$ is true for all values of x/

Answer: B

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12. State which of the statement is false ?

A. the formula $\sec^{-1}x + \operatorname{cosec}^{-1}x = \frac{\pi}{2}$ holds when $|x| \geq 1$.

B. $\sin^{-1}\cos\tan^{-1}\sqrt{3}$represents an angle .

C. If $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right) = \theta$, then the value of $\operatorname{cosec}^{-1}\sqrt{5}$ will be $\left(\frac{\pi}{2} - \theta\right)$

D. If $\sin^{-1} x = \theta$, then the value of $\operatorname{cosec}^{-1}\left(\frac{1}{\sqrt{1-x^2}}\right)$ is also θ

Answer: D

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13. which of the following is the value of $\cot\left(\operatorname{cosec}^{-1}2 + \cos^{-1}\frac{1}{2}\right)$?

A. 1

B. 0

C. -1

D. $\sqrt{3}$

Answer: B

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14. state which of the following is the value of $\left(\cos^{-1}\frac{1}{2}+2\sin^{-1}\frac{1}{2}\right)$?

A. $\frac{5\pi}{6}$

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

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

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

Answer: C

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15. If $\sec^{-1}x=\operatorname{cosec}^{-1}y$. State which of the following is the value of $\left(\cos^{-1}\frac{1}{x}+\cos^{-1}\frac{1}{y}\right)$?

A. π

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

C. $\frac{5\pi}{6}$

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

Answer: D

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16. If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$ state which of the following is the value of x?

A. 1

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

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

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

Answer: D

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17. State which of the following is the value of $\tan\frac{1}{3}\left(\tan^{-1}x+\tan^{-1}\frac{1}{x}\right)(x>0)$?

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

B. $\sqrt{3}$

C. 1

D. 0

Answer: A

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Very Short Answer Type Questions

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

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2. $\operatorname{cosec} \sec^{-1}\left(\frac{5}{4}\right)$

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

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

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5. $\tan^{-1} \cot 320^{\circ}$

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

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7. $\cos^{-1}\sin(-60^\circ)$

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8. $\cos^{-1}\tan 0^\circ$

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

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10. $\cos\sin^{-1}\left(\frac{3}{5}\right)$

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11. $\tan \cot^{-1}\left(-\frac{7}{2}\right)$

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12. $\sec^2 \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^2 \operatorname{cosec}^{-1}(\sqrt{2})$

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

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

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15. $\sin^{-1}\left(\frac{3}{5}\right) + \operatorname{cosec}^{-1}\left(\frac{5}{4}\right)$

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16. $\cot\left(\sin^{-1}\frac{1}{\sqrt{5}} + \sin^{-1}\frac{2}{\sqrt{5}}\right)$

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17. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$

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18. $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$

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19. Express each of the following in terms of other inverse circular functions :

$\sin^{-1}\frac{12}{13}$

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20. Express each of the following in terms of other inverse circular functions :

$\tan^{-1}x(x>0)$

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21. $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{2}{11}=\tan^{-1}\frac{3}{4}$

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22. $\cos^{-1}\frac{1}{\sqrt{5}}+\cos^{-1}\frac{2}{\sqrt{5}}=\frac{\pi}{2}$

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23. $2\tan^{-1}\frac{1}{2} = \tan^{-1}\frac{4}{3}$

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24. $2\tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{8} = \tan^{-1}\frac{4}{7}$

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25. $\sin^{-1}\frac{3}{5} + \sin^{-1}\frac{8}{17} = \sin^{-1}\frac{77}{85}$

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26. $\cos^{-1}\frac{15}{17} + \cos^{-1}\frac{3}{5} = \cos^{-1}\frac{13}{85}$

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27. $\tan^{-1} a + \cot^{-1} b = \cot^{-1} \frac{b-a}{1+ab}$

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28. $4\left(\cot^{-1} 3 + \operatorname{cosec}^{-1} \sqrt{5}\right) = \pi$

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29. $\sin^{-1} \frac{1}{\sqrt{5}} + \cot^{-1} 3 = \frac{\pi}{4}$

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30. $\tan^{-1} \sqrt{x} = \frac{1}{2} \cos^{-1} \frac{1-x}{1+x}, 0 \leq x \leq 1$

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31. $\sec^2\left(\tan^{-1} 3\right) + \operatorname{coses}^2\left(\cot^{-1} 4\right) = 27$

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32. $\sec^2(\cot^{-1}2) + \operatorname{cosec}^2(\tan^{-1}3) = 2\frac{13}{36}$

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33. if two angles of a triangle are $\tan^{-1}\frac{1}{2}$ and $\tan^{-1}\frac{1}{3}$, then find the third angle .

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34. If two angles of a triangle are $\tan^{-1}2$ and $\tan^{-1}3$, what is the third angle ?

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35. $2\sin^{-1}x = \cos^{-1}x$

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36. $\tan^{-1}\frac{1}{x}+\tan^{-1}2=\frac{\pi}{2}$

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37. $2\tan^{-1}\frac{2x}{1-x^2}=\frac{\pi}{3}$

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38. $\tan^{-1}(\cot x)+\cot^{-1}(\tan x)=\frac{\pi}{4}$

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39. $\tan^{-1}\frac{1-x}{1+x}-\frac{1}{2}\tan^{-1}x=0$ where $x>0$

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Short Answer Type Questions

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

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2. $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{2}{11}=\cos^{-1}\frac{4}{5}$

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3. $\sin^{-1}\frac{77}{85}-\cos^{-1}\frac{15}{17}=\sin^{-1}\frac{3}{5}$

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4. $2\left(\tan^{-1}\frac{1}{4}+\tan^{-1}\frac{2}{9}\right)=\cos^{-1}\frac{3}{5}$

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

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6. $\cos^{-1}\frac{2}{\sqrt{5}}+\sin^{-1}\frac{1}{\sqrt{10}}=\frac{\pi}{4}$

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7. $2\sin^{-1}\frac{3}{5}+\sin^{-1}\frac{7}{25}=\frac{\pi}{2}$

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

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9. $\tan^{-1}x+\cot^{-1}(x+1)=\tan^{-1}(1+x+x^2)$

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10. $\tan^{-1}\frac{1}{p+q}+\tan^{-1}\frac{q}{p^2+pq+1}=\cot^{-1}p$

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11. $\tan^{-1}\frac{3}{2}+\tan^{-1}\frac{6}{5}=\pi-\tan^{-1}\frac{27}{8}$

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12. $\tan\left(\frac{1}{2}\sin^{-1}\frac{2x}{1+x^2}+\frac{1}{2}\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right)=\frac{2x}{1-x^2}(|x|\neq 1)$

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13. $\tan^{-1}x-\tan^{-1}y=\sin^{-1}\frac{x-y}{\sqrt{(1+x^2)(1+y^2)}}$

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14. $\sin^{-1} x + \sin^{-1} y = \cos^{-1}\left\{\sqrt{(1-x^2)(1-y^2)} - xy\right\}$

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15. $\sin^{-1}\dfrac{2a}{1+a^2} - \cos^{-1}\dfrac{1-b^2}{1+b^2} = 2\tan^{-1}\dfrac{a-b}{1+ab}$

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16. $\cot^{-1}\dfrac{xy+1}{x-y} + \cot^{-1}\dfrac{yz+1}{y-z} + \cot^{-1}\dfrac{zx+1}{z-x} = 0$

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17.

$\tan^{-1}\dfrac{x-y}{1+xy} + \tan^{-1}\dfrac{y-z}{1+yz} + \tan^{-1}\dfrac{z-x}{1+zx} = \tan^{-1}\dfrac{x^2-y^2}{1+x^2y^2} + \tan$

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18.

$$\cos^{-1} x = 2\sin^{-1}\sqrt{\frac{1-x}{2}} = 2\cos^{-1}\sqrt{\frac{1+x}{2}} = 2\tan^{-1}\frac{\sqrt{1-x^2}}{1+x}$$

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19. $\{\cos(\sin^{-1} x)\}^2 = \{\sin(\cos^{-1} x)\}^2$

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20. $\tan^1(\cot x) + \cot^{-1}(\tan x) = \pi - 2x$

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21. $\tan^{-1}(\cot x) + \cot^{-1}(\tan x) = \pi - 2x$

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22. $\sin\cos^{-1}\tan\left(\sec^{-1}x\right) = \sqrt{2-x^2}$

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23. $\sin\operatorname{cosec}^{-1}\cot\left(\tan^{-1}x\right) = x$

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24. $\sin\cot^{-1}\cos\left(\tan^{-1}x\right) = \sqrt{\dfrac{x^2+1}{x^2+2}}(x>0)$

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25. $\tan\left[\dfrac{1}{2}\sin^{-1}\dfrac{2x}{1+x^2}+\dfrac{1}{2}\cos^{-1}\dfrac{1-y^2}{1+y^2}\right], xy \neq 1$

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

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27. $2\tan^{-1}\frac{1+x}{1-x}+\sin^{-1}\frac{1-x^2}{1+x^2}$

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28. $\tan\left(\sin^{-1}x+\sin^{-1}y\right)+\tan\left(\cos^{-1}x+\cos^{-1}y\right)$

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29. If $xy=1+a^2$ then show that

$$\tan^{-1}\frac{1}{a+x}+\tan^{-1}\frac{1}{a+y}=\tan^{-1}\frac{1}{a},\ x+y+2a\neq 0$$

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30. If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \frac{\pi}{2}$, show that ,

$xy + yz + zx = 1$

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31. if $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$ prove that

$x + y + z = xyz$

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32. 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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33. 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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34. IF $\cos(\alpha+\beta)=\frac{5}{13}$ and $\cos(\alpha-\beta)=\frac{4}{5}$, then find the value of $\tan 2\beta$.

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35. If $\tan^{-1}y=4\tan^{-1}x$, find the algebric relation between x and y

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36. If $\tan^{-1}x, \tan^{-1}y$ and $\tan^{-1}z$ are in A.P find the agebraic realation between x, y and z, IF x,y , z be also in A.P then show that $x=y=z[y\neq 0]$

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37. $\tan^{-1}(x+1)+\tan^{-1}(x-1)=\tan^{-1}\frac{8}{31}$

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

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

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40. $\sin^{-1} \frac{2a}{1+a^2} + \sin^{-1} \frac{2b}{1+b^2} = 2\tan^{-1} x$

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

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

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43. $\sin^{-1}\cos\sin^{-1}x=\frac{\pi}{3}$

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44. $\tan^{-1}x+\tan^{-1}(1-x)=2\tan^{-1}\sqrt{x(1-x)}$

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45. $3\sin^{-1}\frac{2x}{1+x^2}-4\cos^{-1}\frac{1-x^2}{1+x^2}+2\tan^{-1}\frac{2x}{1-x^2}=\frac{\pi}{3}$

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Long Answer Type Questions

1. $\cot^{-1}\frac{1}{2}-\frac{1}{2}\cot^{-1}\frac{4}{3}=\frac{\pi}{4}$

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

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3. $4\tan^{-1}\frac{1}{5}-\tan^{-1}\frac{1}{239}=\frac{\pi}{4}$

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4.

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

`[take priencipal value in each case]

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5. $3\tan^{-1}\frac{1}{2+\sqrt{3}}-\tan^{-1}\frac{1}{2}=\tan^{-1}\frac{1}{3}$

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6. $\cos^{-1}\frac{3}{5}+\cos^{-1}\frac{12}{13}+\cos^{-1}\frac{63}{65}=\frac{\pi}{2}$

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

$$=\begin{cases} 0\text{when } \frac{\pi}{4}<A\leq\frac{\pi}{2} \\ \pi\text{when } 0\leq A\leq\frac{\pi}{4} \end{cases}$$

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8. $2\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right)=\cos^{-1}\frac{a\cos x+b}{a+b\cos x}$

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9. $\tan\left(2\tan^{-1}\sqrt{\frac{1+\cos\theta}{1-\cos\theta}}\right)+\tan\theta=0$

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10. $\tan^{-1}\left\{\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right\}=\frac{\pi}{4}+\frac{x}{2}, 0<x<\frac{\pi}{2}$

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11. $\cos^{-1}\left(\frac{\cos x+\cos y}{1+\cos x\cos y}\right)=2\tan^{-1}\left(\tan\frac{x}{2}\tan\frac{y}{2}\right)$

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12. $\frac{1}{2}\cos^{-1}\left(\frac{5\cos x+3}{5+3\cos x}\right)=\tan^{-1}\left(\frac{1}{2}\tan\frac{x}{2}\right)$

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13. $\tan^{-1}\frac{1-x}{1+x}-\tan^{-1}\frac{1-y}{1+y}=\sin^{-1}\frac{y-x}{\sqrt{(1+x^2)(1+y^2)}}$

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14. If $\cos^{-1}x+\cos^{-1}y=\theta,$ show that $x^2-2xy\cos\theta+y^2=\sin^2\theta$

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15. If $\sin(\pi\cos\theta)=\cos(\pi\sin\theta),$, then show that $\theta=\pm\frac{1}{2}\sin^{-1}\frac{3}{4}$

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16. Prove that , $a\cos\theta+b\sin\theta=\sqrt{a^2+b^2}\cos\left(\theta-\tan^{-1}\frac{b}{a}\right)$

$=\sqrt{a^2+b^2}\sin\left(\theta+\tan^{-1}\frac{a}{b}\right)$

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17. IF $2\cos 4\theta + 9\cos 2\theta - 7 = 0$, then show that ,$\theta = \frac{1}{2}\cos^{-1}\frac{3}{4}$

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18. $\cot^{-1} x + \cot^{-1} 2x = \frac{3\pi}{4}$

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19. $\cot^{-1} x + \cot^{-1}\left(a^2 - x + 1\right) = \cot^{-1}(a - 1)$

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20. $\tan^{-1}\frac{1-x}{1+x} = \frac{1}{2}\sin^{-1}\frac{x}{\sqrt{1+x^2}}$

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21. $\sin^{-1} x + \sin^{-1}(1 - x) = \cos^{-1} x$

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22. $\cos^{-1}\frac{5}{x}+\cos^{-1}\frac{12}{x}=\frac{\pi}{2}$

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23. $3\cot^{-1}\frac{1}{2-\sqrt{3}}+\cot^{-1}x=\frac{\pi}{2}$

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

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

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26. $\sin^{-1} x - \sin^{-1} y = \frac{\pi}{3}$ and $\cos^{-1} x + \cos^{-1} y = \frac{2\pi}{3}$

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27. $\sin^{-1} \frac{ax}{C} + \sin^{-1} \frac{bx}{c} = \sin^{-1} x$ where $a^2 + b^2 = c^2$ and $c \neq 0$

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28. $2\tan^{-1}(\cos x) = \tan^{-1}(2\text{cosec}x)$

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Sample Questions For Competive Examination

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

A. 0

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

C. 1

D. 2

Answer: A::B

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2. $\sin^{-1} x > \cos^{-1} x$ golds for -

A. all values of x

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

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

D. $x = 0.75$

Answer: C::D

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3. If $\operatorname{cosec}^{-1}x = \sin^{-1}\left(\frac{1}{x}\right)$ then x may be -

A. 1

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

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

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

Answer: A::C::D

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4. $2\cot^{-1}7 + \cos^{-1}\left(\frac{3}{5}\right)$ is equal to -

A. $\cot^{-1}\left(\frac{44}{117}\right)$

B. $\operatorname{cosec}^{-1}\left(\frac{125}{117}\right)$

C. $\tan^{-1}\left(\frac{4}{117}\right)$

D. $\cos^{-1}\left(\frac{44}{125}\right)$

Answer: A::B::D

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5. $\theta = \tan^{-1}(2\tan^2\theta) - \tan^{-1}\left(\frac{1}{3}\tan\theta\right)$ if -

A. $\tan\theta = -2$

B. $\tan\theta = 0$

C. $\tan\theta = 1$

D. $\tan\theta = 2$

Answer: A::B::C

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6. $\tan\left\{2\tan^{-1}\left(\frac{1}{5}\right) - \frac{\pi}{4}\right\}$ is equal to -$\frac{k}{17}$ then find the value of K .

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7. IF $\sin^{-1} x \sin^{-1} y = \frac{2\pi}{3}$ then $\cos^{-1} y = \frac{\pi}{\lambda}$. Find the value of λ

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8. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi,$ then $xy + yz + zx$ is equal to

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9. The value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ is equal to $\frac{3\pi}{k}$. Find the value of K.

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10. The value of $\tan\left\{\left(\cos^{-1}\left(-\frac{2}{7}\right) - \frac{\pi}{2}\right)\right\}$ is $\frac{2}{3\sqrt{m}},$ find the value of m.

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11. Find prinicipal values for inverse circular functions $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$.

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12. Find prinicipal values for inverse circular functions $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$

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13. Find prinicipal values for inverse circular functions $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$.

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14. Find prinicipal values for inverse circular functions $\tan^{-1}(\tan(4))$.

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15. Find prinicipal values for inverse circular functions $\cos^{-1}(\cos 5)$

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16. $\cos^{-1}(4x^3 - 3x) = a + b\cos^{-1} x$ is a equation of trigonomatric inverse circular function .

If $x \in \left[-\frac{1}{2}, -1\right]$ then the value of $a + b\pi$ is -

A. 2π

B. 3π

C. π

D. -2π

Answer: C

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17. $\cos^{-1}(4x^3 - 3x) = a + b\cos^{-1} x$ is a equation of trigonomatric inverse circular function .

IF $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$, then the prinicipal value of $\sin^{-1}\left(\sin\frac{a}{b}\right)$ is

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

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

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

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

Answer: A

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18. $\cos^{-1}(4x^3 - 3x) = a + b\cos^{-1}x$ is a equation of trigonomatric inverse circular function .

If $x \in \left(\frac{1}{2}, 1\right)$, then the value of $\lim_{y \to a} b\cos(y)$ is -

A. $-\frac{1}{3}$

B. -3

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

D. 3

Answer: D

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

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20. Statement -I : $\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\frac{\pi}{4}$

statement -II: $\text{for} x>0, y>0$

$\tan^{-1}\left(\frac{x}{y}\right)+\tan^{-1}\left(\frac{y-x}{y+x}\right)=\frac{\pi}{4}$

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 ture : statement -II statement -II is not a correct explantion for statement -I

C. Statement -I is ture statement -II is False

D. Statement -I is False , statement -II is true .

Answer: d

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