



MATHS

NCERT - NCERT MATHEMATICS(ENGLISH)

INVERSE TRIGONOMETRIC FUNCTIONS

Exercise 2 2

1. Write the following function in the simplest form:

$$\tan^{-1}\left(\frac{1}{\sqrt{x^2 - 1}}\right), |x| > 1$$



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2. 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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3. Find the value of:

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

and $xy < 1$



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4. 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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5. $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is equal to

(A) π (B) $-\frac{\pi}{2}$ (C) 0 (D) $2\sqrt{3}$



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

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7. Find the value of: $\tan^{-1} \left[2 \cos \left(2 \frac{\sin^{-1} 1}{2} \right) \right]$

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8. 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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9. Find the value of $\tan\left(\sin^{-1}\left(\frac{3}{5}\right) + \cot^{-1}\left(\frac{3}{2}\right)\right)$

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10. $\cos^{-1}\left(\cos\left(\frac{7\pi}{6}\right)\right)$ is equal to (A) $\frac{7\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

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

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12. $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 1

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13. Find the value of: $\cot(\tan^{-1} a + \cot^{-1} a)$

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

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15. Write the following function in the simplest form: $\frac{\tan^{-1} x}{\sqrt{a^2 - x^2}}$

, $|x| < a$

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16. Write the following function in the simplest form:

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

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17. Write the following function in the simplest form:

$$\tan^{-1} \left(\frac{\sqrt{1+x^2} - 1}{x} \right), x \neq 0$$

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18. 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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19. Write the following function in the simplest form:

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

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

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21. Write the following function in the simplest form:

$$\tan^{-1}\left(\frac{3a^2x - x^3}{a^3 - 3ax^2}\right), a > 0; \frac{-a}{\sqrt{3}} \leq x \leq \frac{a}{\sqrt{3}}$$

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1. $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right)$ is equal to (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$
(D) $\frac{-3\pi}{4}$

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

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3. 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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4. Solve the equations. $\sin(\tan^{-1} x), |x| < 1$ (A) $\frac{x}{\sqrt{1-x^2}}$ (B) $\frac{1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{x}{\sqrt{1+x^2}}$

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5. $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$, then x is equal to (A) 0, $\frac{1}{2}$ (B) 1, $\frac{1}{2}$ (C) 0 (D) $\frac{1}{2}$

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6. Prove that

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

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7.

Prove

that:

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


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8. 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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9. 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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10.

Prove

that:

$$\tan^{-1} \left(\frac{1}{5} \right) + \tan^{-1} \left(\frac{1}{7} \right) + \tan^{-1} \left(\frac{1}{3} \right) + \tan^{-1} \left(\frac{1}{8} \right) = \frac{\pi}{4}$$



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11. Prove that: $\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right)$



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12. Find the value of the following: $\tan^{-1}\left(\tan\left(\frac{7\pi}{6}\right)\right)$



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13. Prove that: $2 \sin^{-1}\left(\frac{3}{5}\right) = \tan^{-1}\left(\frac{24}{7}\right)$



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14. Find the value of the following: $\cos^{-1}\left(\cos\left(\frac{13\pi}{6}\right)\right)$

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15. Prove 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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16. 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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17. Solve the equations. $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}x, (x > 0)$

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Exercise 2 1

1. Find the principal value of: $\cot^{-1}(\sqrt{3})$



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



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



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



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5. Find the principal value of: $\cos^{-1}(2)$



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6. Find the principal value of: $\tan^{-1}(-\sqrt{3})$



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



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8. Find the principal value of: $\tan^{-1}(-1)$



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



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



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11. If $s \in^{-1} x = y$, then (A) $0 \leq y \leq \pi$ (B) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$ (C) $0 < y < \pi$ (d) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

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

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13. Find the value of:

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

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



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Solved Examples

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



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2. Find the value of $\cos(\sec^{-1} x + \cos ec^{-1} x)$, $|x| \geq 1$



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3. Show that (i)

$$\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\sin^{-1}x, \quad -\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}} \quad \text{(ii)}$$

$$\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\cos^{-1}x, \quad \frac{1}{\sqrt{2}} \leq x \leq 1$$



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



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



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6. Prove that

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



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7. Write $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right)$, $|x| > 1$ in the simplest form.

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8. Express $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$ in the simplest form.

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

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10. Show that $\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$

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11. Show that $\frac{\sin^{-1}(12)}{13} + \frac{\cos^{-1} 4}{5} + \frac{\tan^{-1}(63)}{16} = \pi$.

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12. Simplify $\tan^{-1} \left[\frac{a \cos x - b \sin x}{b \cos x + a \sin x} \right]$, if $\frac{a}{b} \tan x > -1$.

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

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