



MATHS

NCERT - NCERT MATHEMATICS(GUJRATI)

INVERSE TRIGONOMETRIC FUNCTIONS

Example

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



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



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



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5. Express $\tan^{-1}\left(\frac{\cos x}{1 - \sin x}\right)$, $-\frac{3\pi}{2} < x < \frac{\pi}{2}$ in the simplest form.

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

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7. 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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8. Find the value of $\cos(\sec^{-1} x + \operatorname{cosec}^{-1} x)$, $|x| \geq 1$

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

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

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11. Prove 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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Exercise 2 1

1. Find the Principle values of the following :

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



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2. Find the Principle values of the following :

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



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3. Find the Principle values of the following :

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



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4. Find the Principle values of the following :

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



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5. Find the Principle values of the following :

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



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6. Find the Principle values of the following :

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

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7. Find the Principle values of the following :

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

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8. Find the Principle values of the following :

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

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9. Find the Principle values of the following :

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

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10. Find the Principle values of the following :

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

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11. Find the values of the following :

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

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12. Find the values of the following :

$$\cos^{-1} \frac{1}{2} + 2\sin^{-1} \frac{1}{2}$$

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13. Find the values of the following :

If $\sin^{-1} x = y$ then

A. $0 \leq y \leq \pi$

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

C. $0 < y < \pi$

D. $-\frac{\pi}{2} < y < \frac{\pi}{2}$

Answer: B



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14. Find the values of the following :

$\tan^{-1} \sqrt{3} - \sec^{-1}(-2)$ is equal to

A. π

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

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

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

Answer: B



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Exercise 2 2

1. Prove the following :

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

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2. Prove the following :

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

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3. Prove the following :

$$\tan^{-1} \frac{2}{11} + \tan^{-1} \frac{7}{24} = \tan^{-1} \frac{1}{2}$$

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4. Prove the following :

$$2\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{7} = \tan^{-1}\frac{31}{17}$$

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5. Write the following function in the simplest form:

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

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6. Write the following function in the simplest form:

$$\frac{\tan^{-1} 1}{\sqrt{x^2-1}}, |x| > 1$$

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7. Write the following function in the simplest form: $\tan^{-1}\left(\frac{\sqrt{(1-\cos x)}}{(1+\cos x)}\right), x$

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8. Write the following function in the simplest form :

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

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9. Write the following function in the simplest form:

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

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10. 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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11. Find the values of each of the following :

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

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12. Find the values of each of the following :

$$\cot(\tan^{-1} a + \cot^{-1} a)$$

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13. Find the value of the following:

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

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14. Find the values of each of the following :

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

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15. 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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16. Find the values of each of the expression following :

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

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17. Find the value of each of the expressions in

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

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

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

A. $\frac{7\pi}{6}$

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

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

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

Answer: B

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

(D) 1

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

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

C. $\frac{1}{4}$

D. 1

Answer: D



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

(D) $2\sqrt{3}$

A. π

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

C. 0

D. $2\sqrt{3}$

Answer: B



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Miscellaneous Exercise

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



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



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

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

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

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

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

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

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

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11. $2 \tan^{-1}(\cos x) = \tan^{-1}(2 \operatorname{cosec} x)$

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12. Solve the following equations :

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

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13. $\sin(\tan^{-1} x)$, $|x| < 1$ is equal to

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

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

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

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

Answer: D



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14. Solve the following equations :

$\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$ then x is equal to

A. $0, \frac{1}{2}$

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

C. 0

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

Answer: C



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15. Solve the following equations :

$\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\frac{x-y}{x+y}$ is equal to

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

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

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

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

Answer: C



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