Inverse Trigonometry Important Questions

Here are some of the important formulas for **inverse trigonometric functions** that are crucial for Tamil Nadu State Board 12th Mathematics:

1. Basic Definitions:

- $\sin^{-1} x = \theta \implies \sin\theta = x, \quad -1 \leq x \leq 1$
- $\cos^{-1} x = \theta \implies \cos\theta = x, \quad -1 \leq x \leq 1$
- $\tan^{-1} x = \theta \implies \tan\theta = x, \quad -\infty < x < \infty$
- $\cot^{-1} x = \theta \implies \cot\theta = x, \quad -\infty < x < \infty$
- $\sec^{-1} x = \theta \implies \sec\theta = x, \quad |x| \geq 1$
- $\csc^{-1} x = \theta \implies \csc\theta = x, \quad |x| \geq 1$

2. Principal Values:

- $\sin^{-1} x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
- $\cos^{-1} x \in [0, \pi]$
- $\tan^{-1} x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- $\cot^{-1} x \in (0, \pi)$
- $\sec^{-1} x \in [0, \pi], x \neq (0, \pi)$
- $\csc^{-1} x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], x \neq 0$

3. Reciprocal Relations:

- $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$
- $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}$
- $\sec^{-1} x + \csc^{-1} x = \frac{\pi}{2}$

4. Addition and Subtraction Formulas:

- $\tan^{-1} x + \tan^{-1} y = \tan^{-1}\left(\frac{x+y}{1-xy}\right), \quad xy < 1$
- $\tan^{-1} x - \tan^{-1} y = \tan^{-1}\left(\frac{x-y}{1+xy}\right), \quad xy > -1$

5. Double Angle Formulas:

- $\sin^{-1} 2x = 2\sin^{-1} x, \quad -\frac{1}{2} \leq x \leq \frac{1}{2}$
- $\tan^{-1} 2x = 2\tan^{-1} x$

6. Inverse Trigonometric Identities:

- $\sin^{-1}(-x) = -\sin^{-1}(x)$
- $\cos^{-1}(-x) = \pi - \cos^{-1}(x)$
- $\tan^{-1}(-x) = -\tan^{-1}(x)$

7. Relation with Logarithms (for advanced questions):

- $\tan^{-1} x + \tan^{-1} y = \log\left(\frac{x}{y}\right)$ (for certain conditions in calculus)

These formulas are crucial for solving problems related to inverse trigonometry, especially in derivations and integrations.