Mathematics

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(Chapter 2)(Inverse Trigonometric Functions)

(Class XII)

(Exemplar Problems)

Short Answer (S.A.)

Question 11:

Solve the following equation $cos(tan^{-1}x) = sin\left(cot^{-1}\frac{3}{4}\right)$.

Answer 11:

Given that:

$$cos(tan^{-1}x) = sin\left(cot^{-1}\frac{3}{4}\right)$$

$$\Rightarrow cos\left(cos^{-1}\frac{1}{\sqrt{x^2+1^2}}\right) = sin\left(sin^{-1}\frac{4}{\sqrt{4^2+3^2}}\right)$$

$$\left[\text{as } tan^{-1}\frac{a}{b} = cos^{-1}\frac{b}{\sqrt{b^2+a^2}} \text{ and } cot^{-1}\frac{a}{b} = sin^{-1}\frac{b}{\sqrt{b^2+a^2}}\right]$$

$$\Rightarrow \frac{1}{\sqrt{x^2+1^2}} = \frac{4}{\sqrt{4^2+3^2}}$$

$$\Rightarrow \frac{1}{\sqrt{x^2+1}} = \frac{4}{5}$$

Squaring both sides

$$\frac{1}{x^2+1} = \frac{16}{25}$$

$$\Rightarrow 25 = 16x^2 + 16$$

$\Rightarrow 16x^2 = 9$

$\Rightarrow x^2 = \frac{9}{16}$

$\Rightarrow x = \pm\frac{3}{4}$

Hence, $x = \frac{3}{4}$ or $x = -\frac{3}{4}$.