Example 17 Solve for x

$$\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1} x, \; x > 0$$

Solution From given equation, we have $2\tan^{-1}\left(\frac{1-x}{1+x}\right) = \tan^{-1} x$

$$\Rightarrow \qquad 2\left[\tan^{-1} 1 - \tan^{-1} x\right] = \tan^{-1} x$$

$$\Rightarrow \qquad 2\left(\frac{\pi}{4}\right) = 3\tan^{-1} x \Rightarrow \frac{\pi}{6} = \tan^{-1} x$$

$$\Rightarrow \qquad x = \frac{1}{\sqrt{3}}$$