① $\operatorname{cosec}\theta + \cot\theta = p$

$\Rightarrow \frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta} = p$

$\Rightarrow \frac{1+\cos\theta}{\sin\theta} = p \quad \ldots$

Squaring both sides

$\frac{(1+\cos\theta)^2}{\sin^2\theta} = p^2$

$\Rightarrow p^2 = \frac{(1+\cos\theta)^2}{1-\cos^2\theta}$

$= \frac{(1+\cos\theta)^2}{(1-\cos\theta)(1+\cos\theta)}$

$= \frac{1+\cos\theta}{1-\cos\theta}$

$RHS = \frac{p^2-1}{p^2+1}$

$= \frac{\frac{1+\cos\theta}{1-\cos\theta} - \frac{1}{1}}{\frac{1+\cos\theta}{1-\cos\theta} + \frac{1}{1}}$

$= \frac{\frac{1+\cos\theta-1+\cos\theta}{(1-\cos\theta)}}{\frac{1+\cos\theta+1-\cos\theta}{(1-\cos\theta)}}$

$= \frac{2\cos\theta}{2}$

$= LHS$

② LHS

$= \sqrt{\sec^2\theta + \operatorname{cosec}^2\theta}$

$= \sqrt{\frac{1}{\cos^2\theta} + \frac{1}{\sin^2\theta}}$

$= \sqrt{\frac{\sin^2\theta+\cos^2\theta}{\sin^2\theta\cos^2\theta}}$

$= \sqrt{\frac{1}{\sin^2\theta\cos^2\theta}}$

$= \frac{1}{\sin\theta\cos\theta}$

$= \frac{\sin^2\theta+\cos^2\theta}{\sin\theta\cos\theta}$

$= \frac{\sin^2\theta}{\sin\theta\cos\theta} + \frac{\cos^2\theta}{\sin\theta\cos\theta}$

$= \tan\theta + \cot\theta$

$= RHS$

NCERT Exemplar Solutions by Dev Anoop (Bathinda)