$$\sin^2 X + \cos^2 X = 1$$

1.) $(\sin X - \cos X)^2 - 1 = -2 \sin X \cos X$

$(\sin X - \cos X)(\sin X - \cos X) - 1$

$\sin^2 X - \sin X \cos X - \sin X \cos X + \cos^2 X - 1$

$\sin^2 X + \cos^2 X - 2 \sin X \cos X$

$1 - 2 \sin X \cos X - 1$

$-2 \sin X \cos X$

$$\cos x \sec x \left[\cot^2 x = \csc^2 x - 1\right]$$

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

$$\frac{\cos^2 x}{\sin^2 x} = \frac{1}{\sin^2 x} - 1$$

$$1 = \frac{\sin^2 x}{\sin^2 x}$$

$$\frac{\cos^2 x}{\sin^2 x} = \frac{1}{\sin^2 x} - \frac{\sin^2 x}{\sin^2 x}$$

$$\cos^2 x = 1 - \sin^2 x$$

$$+\sin^2 x \qquad +\sin^2 x$$

$$\sin^2 x + \cos^2 x = 1$$

3.) $\dfrac{\tan x - \cot x}{\tan x + \cot x} = \sin^2 x - \cos^2 x$

$$\frac{\left[\frac{\sin x}{\sin x}\,\frac{\sin x}{\cos x}\right] - \left[\frac{\cos x}{\sin x}\,\frac{\cos x}{\cos x}\right]\frac{\sin^2 x}{\sin x \cos x} - \frac{\cos^2 x}{\sin x \cos x}}{\left[\frac{\sin x}{\sin x}\,\frac{\sin x}{\cos x}\right] + \left[\frac{\cos x}{\sin x}\,\frac{\cos x}{\cos x}\right]\frac{\sin^2 x}{\sin x \cos x} + \frac{\cos^2 x}{\sin x \cos x}}$$

$$\frac{\dfrac{\sin^2 x - \cos^2 x}{\sin x \cos x}}{\dfrac{\sin^2 x + \cos^2 x}{\sin x \cos x}}$$

$$\frac{\sin^2 x - \cos^2 x}{\sin x \cos x} \div \frac{\sin^2 x + \cos^2 x}{\sin x \cos x}$$

$$\frac{\sin^2 x - \cos^2 x}{\sin x \cos x} \cdot \frac{\sin x \cos x}{\sin^2 x + \cos^2 x} = \sin^2 x - \cos^2 x$$

$$\frac{\sin^2 x - \cos^2 x}{1} \cdot \frac{1}{1} = \sin^2 x - \cos^2 x$$

$$\left[\frac{\sin x + 1}{\sin x}\right] = -\frac{\cot^2 x}{1 - \csc x}$$

$$-\frac{\frac{\cos^2 x}{\sin^2 x}}{\frac{\sin^2 x}{\sin^2 x} - \left(\frac{1}{\sin x}\right)\left(\frac{\sin x}{\sin x}\right)} = -\frac{\frac{\cos^2 x}{\sin^2 x}}{\frac{\sin^2 x - \sin x}{\sin^2 x}} \quad \begin{matrix}\text{NUM}\\ \text{DEN}\end{matrix}$$

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

$$\sin^2 x + \cos^2 x = 1$$

$$-\cos^2 x \quad -\cos^2 x$$

$$\sin^2 x = 1 - \cos^2 x$$

$$-1 \quad -1$$

$$\boxed{\sin^2 x - 1} = -\cos^2 x$$

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

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

Difference of squares

$$\frac{(\sin x + 1)(\sin x - 1)}{\sin x(\sin x - 1)} = \frac{\sin x + 1}{\sin x}$$