

1. Verify the Identity:

Ans: Please note that there are more than one approach to any of the identity problems. Your approach may be different but may still be correct.

a.  $\frac{\cos^2 x - \sin^2 x}{\cos x \sin x} = \cot x - \tan x$

Ans: L.H.S. =  $\frac{\cos^2 x}{\cos x \sin x} - \frac{\sin^2 x}{\cos x \sin x} = \frac{\cos x}{\sin x} - \frac{\sin x}{\cos x} = \cot x - \tan x = \text{R.H.S.}$

b.  $\frac{\cos x - \sin x}{\cos x \sin x} = \csc x - \sec x$

Ans: LHS =  $\frac{\cos x}{\cos x \sin x} - \frac{\sin x}{\cos x \sin x} = \frac{1}{\sin x} - \frac{1}{\cos x} = \csc x - \sec x = \text{RHS.}$

c.  $\frac{\tan x + 1}{\sec x} = \sin x + \cos x$

Ans: LHS =  $\frac{\tan x}{\sec x} + \frac{1}{\sec x} = \tan x \cdot \frac{1}{\sec x} + \frac{1}{\sec x} = \frac{\sin x}{\cos x} \cdot \cos x + \cos x = \sin x + \cos x = \text{RHS.}$

d.  $\frac{\sin x + 1}{\cos x} = \frac{\cos x}{1 - \sin x}$

Ans:

$$\begin{aligned} \text{LHS} &= \frac{(\sin x + 1)(\cos x)}{(\cos x)(\cos x)} = \frac{(\sin x + 1)(\cos x)}{(\cos^2 x)} = \frac{(\sin x + 1)(\cos x)}{1 - \sin^2 x} = \frac{(\sin x + 1)(\cos x)}{(1 - \sin x)(1 + \sin x)} = \\ &\frac{\cos x}{1 - \sin x} = \text{RHS.} \end{aligned}$$

e.  $\tan x + \cot x = \sec x \csc x$

Ans: LHS =  $\tan x + \cot x = \frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = \frac{\sin^2 x + \cos^2 x}{\cos x \sin x} = \frac{1}{\cos x \sin x} = \frac{1}{\cos x} \cdot \frac{1}{\sin x} = \sec x \csc x = \text{RHS.}$

f.  $\frac{\sin(x+h) - \sin x}{h} = (\sin x) \left( \frac{(\cos h) - 1}{h} \right) + (\cos x) \left( \frac{\sin h}{h} \right)$

Ans: LHS =  $\frac{\sin(x+h) - \sin x}{h} = \frac{\sin x \cos h + \cos x \sin h - \sin x}{h} =$

$$\begin{aligned}\frac{(\sin x \cos h - \sin x) + \cos x \cos h}{h} &= \frac{\sin x(\cos h - 1) + \cos x \sin h}{h} = \\ \frac{\sin x(\cos h - 1)}{h} + \frac{\cos x \sin h}{h} &= \sin x \cdot \frac{\cos h - 1}{h} + \cos x \cdot \frac{\sin h}{h} = \text{RHS.}\end{aligned}$$

g.  $\frac{\cos x - \cos 3x}{\sin x + \sin 3x} = \tan x$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\cos x - \cos 3x}{\sin x + \sin 3x} = \frac{-2 \sin\left(\frac{x+3x}{2}\right) \sin\left(\frac{x-3x}{2}\right)}{2 \sin\left(\frac{x+3x}{2}\right) \cos\left(\frac{x-3x}{2}\right)} = \frac{-2 \sin\left(\frac{4x}{2}\right) \sin\left(\frac{-2x}{2}\right)}{2 \sin\left(\frac{4x}{2}\right) \cos\left(\frac{-2x}{2}\right)} = \\ &\frac{-\sin(2x) \sin(-x)}{\sin(2x) \cos x} = \frac{\sin(2x) \sin x}{\sin(2x) \cos x} = \frac{\sin x}{\cos x} = \tan x = \text{RHS.}\end{aligned}$$

h.  $\frac{\sin x}{1 - \cos x} = (\csc x)(1 + \cos x)$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin x}{1 - \cos x} = \frac{(\sin x)(1 + \cos x)}{(1 - \cos x)(1 + \cos x)} = \frac{\sin x(1 + \cos x)}{1 - \cos^2 x} = \frac{\sin x(1 + \cos x)}{\sin^2 x} = \\ &\frac{1 + \cos x}{\sin x} = (1 + \cos x) \cdot \frac{1}{\sin x} = (1 + \cos x) \csc x = \text{RHS.}\end{aligned}$$

i.  $\frac{\sin 2x}{\cot x} = 1 - \cos 2x$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin 2x}{\cot x} = \frac{2 \sin x \cos x}{\cot x} = 2 \sin x \cos x \cdot \frac{1}{\cot x} \\ &= 2 \sin x \cos x \tan x = 2 \sin x \cos x \cdot \frac{\sin x}{\cos x} = 2 \sin^2 x = \sin^2 x + \sin^2 x = \\ &(1 - \cos^2 x) + \sin^2 x = 1 - (\cos^2 x - \sin^2 x) = 1 - \cos 2x = \text{RHS.}\end{aligned}$$

j.  $\frac{\sin(x - y)}{\sin(x + y)} = \frac{\tan x - \tan y}{\tan x + \tan y}$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin x \cos y - \cos x \sin y}{\sin x \cos y + \cos x \sin y} = \frac{(\sin x \cos y - \cos x \sin y)/(\cos x \cos y)}{(\sin x \cos y + \cos x \sin y)/(\cos x \cos y)} = \\ &\frac{\frac{\sin x \cos y - \cos x \sin y}{\cos x \cos y}}{\frac{\sin x \cos y + \cos x \sin y}{\cos x \cos y}} = \frac{\frac{\sin x \cos y}{\cos x \cos y} - \frac{\cos x \sin y}{\cos x \cos y}}{\frac{\sin x \cos y}{\cos x \cos y} + \frac{\cos x \sin y}{\cos x \cos y}} = \frac{\frac{\sin x}{\cos x} - \frac{\sin y}{\cos y}}{\frac{\sin x}{\cos x} + \frac{\sin y}{\cos y}} = \frac{\tan x - \tan y}{\tan x + \tan y} = \text{RHS.}\end{aligned}$$

k.  $\frac{2 - \sec^2 x}{\sec^2 x} = \cos 2x$

$$\text{Ans: LHS} = \frac{2 - \sec^2 x}{\sec^2 x} = \frac{2}{\sec^2 x} - \frac{\sec^2 x}{\sec^2 x} = 2 \cos^2 x - 1 = \cos 2x = \text{RHS.}$$

l.  $\frac{\sin x + \sin 5x}{\cos x + \cos 5x} = \tan 3x$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin x + \sin 5x}{\cos x + \cos 5x} = \frac{2 \sin\left(\frac{x+5x}{2}\right) \cos\left(\frac{x-5x}{2}\right)}{2 \cos\left(\frac{x+5x}{2}\right) \cos\left(\frac{x-5x}{2}\right)} = \frac{\sin\left(\frac{6x}{2}\right) \cos\left(\frac{-4x}{2}\right)}{\cos\left(\frac{6x}{2}\right) \cos\left(\frac{-4x}{2}\right)} = \\ &\frac{\sin 3x \cos(-2x)}{\cos 3x \cos(-2x)} = \frac{\sin 3x}{\cos 3x} = \tan 3x = \text{RHS.}\end{aligned}$$

m.  $\frac{\sin x + \sin y}{\cos x - \cos y} = -\cot \frac{x-y}{2}$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin x + \sin y}{\cos x - \cos y} = \frac{2 \sin\left(\frac{x+y}{2}\right) \cos\left(\frac{x-y}{2}\right)}{-2 \sin\left(\frac{x+y}{2}\right) \sin\left(\frac{x-y}{2}\right)} = -\frac{\cos\left(\frac{x-y}{2}\right)}{\sin\left(\frac{x-y}{2}\right)} = -\cot\left(\frac{x-y}{2}\right) = \\ &\text{RHS.}\end{aligned}$$

n.  $\frac{\cos x - \cos y}{\cos x + \cos y} = -\tan \frac{x+y}{2} \tan \frac{x-y}{2}$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\cos x - \cos y}{\cos x + \cos y} = \frac{-2 \sin\left(\frac{x+y}{2}\right) \sin\left(\frac{x-y}{2}\right)}{2 \cos\left(\frac{x+y}{2}\right) \cos\left(\frac{x-y}{2}\right)} = \frac{-\sin\left(\frac{x+y}{2}\right) \sin\left(\frac{x-y}{2}\right)}{\cos\left(\frac{x+y}{2}\right) \cos\left(\frac{x-y}{2}\right)} = \\ &-\frac{\sin\left(\frac{x+y}{2}\right)}{\cos\left(\frac{x+y}{2}\right)} \cdot \frac{\sin\left(\frac{x-y}{2}\right)}{\cos\left(\frac{x-y}{2}\right)} = -\tan\left(\frac{x+y}{2}\right) \tan\left(\frac{x-y}{2}\right) = \text{RHS.}\end{aligned}$$

o.  $\sec(x+y) = \frac{\sec(x) \sec(y)}{1 - \tan(x) \tan(y)}$

$$\begin{aligned}\text{Ans: LHS} &= \sec(x+y) = \frac{1}{\cos(x+y)} = \frac{1}{\cos x \cos y - \sin x \sin y} = \\ &\frac{\frac{1}{\cos x \cos y}}{\frac{\cos x \cos y - \sin x \sin y}{\cos x \cos y}} = \frac{\frac{1}{\cos x} \cdot \frac{1}{\cos y}}{1 - \frac{\sin x}{\cos x} \cdot \frac{\sin y}{\cos y}} = \frac{\sec x \sec y}{1 - \tan x \tan y} = \text{RHS}\end{aligned}$$

p.  $\frac{\sin(x+y)}{\cos x \cos y} = \tan x + \tan y$

$$\begin{aligned}\text{Ans: LHS} &= \frac{\sin(x+y)}{\cos x \cos y} = \frac{\sin x \cos y + \cos x \sin y}{\cos x \cos y} = \frac{\sin x \cos y}{\cos x \cos y} + \frac{\cos x \sin y}{\cos x \cos y} = \\ &\frac{\sin x}{\cos x} + \frac{\sin y}{\cos y} = \tan x + \tan y = \text{RHS}\end{aligned}$$

q.  $\frac{\cos(x-y)}{\cos x \sin y} = \tan x + \cot y$

Ans: LHS =  $\frac{\cos(x-y)}{\cos x \sin y} = \frac{\cos x \cos y + \sin x \sin y}{\cos x \sin y} = \frac{\cos x \cos y}{\cos x \sin y} + \frac{\sin x \sin y}{\cos x \sin y} = \frac{\cos y}{\sin y} + \frac{\sin x}{\cos x} = \cot y + \tan x = \text{RHS}$

r.  $\sin(x+y) \sin(x-y) = \cos^2 y - \cos^2 x$

Ans: LHS =  $\sin(x+y) \sin(x-y) = \frac{1}{2} (\cos[(x+y)-(x-y)] - \cos[(x+y)+(x-y)]) = \frac{1}{2} (\cos[x+y-x+y] - \cos[x+y+x-y]) = \frac{1}{2} (\cos(2y) - \cos(2x)) = \frac{1}{2} ((2\cos^2(y)-1) - (2\cos^2(x)-1)) = \frac{1}{2} (2\cos^2(y) - 1 - 2\cos^2(x) + 1) = \frac{1}{2} (2\cos^2(y) - 2\cos^2(x)) = \frac{1}{2} (2[\cos^2(y) - \cos^2(x)]) = \cos^2(y) - \cos^2(x) = \text{RHS}$

s.  $\cos(2x) = \frac{1 - \tan^2 x}{1 + \tan^2 x}$

Ans: RHS =  $\frac{1 - \tan^2 x}{1 + \tan^2 x} = \frac{1 - \tan^2 x}{\sec^2 x} = (1 - \tan^2 x) \cdot \frac{1}{\sec^2 x} = (1 - \tan^2 x) \cos^2 x = \cos^2 x - \tan^2 x \cos^2 x = \cos^2 x - \frac{\sin^2 x}{\cos^2 x} \cdot \cos^2 x = \cos^2 x - \sin^2 x = \cos(2x) = \text{LHS}$

t.  $1 + \cos(2x) = \cot x \sin(2x)$

Ans: RHS =  $\cot x \sin(2x) = \frac{\cos x}{\sin x} \cdot 2 \sin x \cos x = 2 \cos^2 x = 2 \cos^2 x - 1 + 1 = (2 \cos^2 x - 1) + 1 = \cos(2x) + 1 = \text{LHS}$

u.  $\sin(3x) = 3 \sin x - 4 \sin^3 x$

Ans: LHS =  $\sin(3x) = \sin(2x+x) = \sin(x) \cos(2x) + \cos(x) \sin(2x) = \sin(x)(1 - 2\sin^2(x)) + \cos(x) \cdot 2 \sin(x) \cos(x) = \sin(x) - 2\sin^3(x) + 2\sin(x)\cos^2(x) = \sin(x) - 2\sin^3(x) + 2\sin(x)(1 - \sin^2(x)) = \sin(x) - 2\sin^3(x) + 2\sin(x) - 2\sin^3(x) = 3\sin(x) - 4\sin^3(x) = \text{RHS}$

v.  $\sin(2x) = \frac{2 \tan x}{1 + \tan^2 x}$

$$\text{Ans: RHS} = \frac{2 \tan x}{1 + \tan^2 x} = 2 \tan x \cdot \frac{1}{\sec^2 x} = 2 \tan x \cos^2 x = 2 \cdot \frac{\sin x}{\cos x} \cdot \cos^2 x =$$

$$2 \sin x \cos x = \sin(2x) = \text{LHS}$$

$$\text{w. } 1 + \tan x \tan(2x) = \tan(2x) \cot(x) - 1$$

$$\begin{aligned}\text{Ans: RHS} &= \tan(2x) \cot(x) - 1 = \tan(2x) \cdot \frac{1}{\tan x} - 1 = \frac{2 \tan x}{1 - \tan^2 x} \cdot \frac{1}{\tan x} - 1 = \\ \frac{2}{1 - \tan^2 x} - 1 &= \frac{2}{1 - \tan^2 x} - \frac{1 - \tan^2 x}{1 - \tan^2 x} = \frac{2 - (1 - \tan^2 x)}{1 - \tan^2 x} = \frac{2 - 1 + \tan^2 x}{1 - \tan^2 x} = \\ \frac{1 + \tan^2 x}{1 - \tan^2 x} &= \frac{1 + \tan^2 x + (\tan^2 x - \tan^2 x)}{1 - \tan^2 x} = \frac{1 + 2 \tan^2 x - \tan^2 x}{1 - \tan^2 x} = \frac{1 - \tan^2 x + 2 \tan^2 x}{1 - \tan^2 x} \\ &= \frac{1 - \tan^2 x}{1 - \tan^2 x} + \frac{2 \tan^2 x}{1 - \tan^2 x} = 1 + \tan x \cdot \frac{2 \tan x}{1 - \tan^2 x} = 1 + \tan x \tan(2x) = \text{LHS}\end{aligned}$$

$$\text{x. } \frac{(\cot x) - 1}{(\cot x) + 1} = \frac{1 - \sin(2x)}{\cos(2x)}$$

$$\begin{aligned}\text{Ans: LHS} &= \frac{(\cot x) - 1}{(\cot x) + 1} = \frac{\frac{\cos x}{\sin x} - \frac{\sin x}{\sin x}}{\frac{\cos x}{\sin x} + \frac{\sin x}{\sin x}} = \frac{\frac{\cos x - \sin x}{\sin x}}{\frac{\cos x + \sin x}{\sin x}} = \frac{\cos x - \sin x}{\cos x + \sin x} = \\ \frac{(\cos x - \sin x)(\cos x - \sin x)}{(\cos x + \sin x)(\cos x - \sin x)} &= \frac{\cos^2 x - 2 \cos x \sin x + \sin^2 x}{\cos^2 x - \sin^2 x} = \\ \frac{\cos^2 x + \sin^2 x - 2 \cos x \sin x}{\cos^2 x - \sin^2 x} &= \frac{1 - 2 \cos x \sin x}{\cos^2 x - \sin^2 x} = \frac{1 - 2 \sin(2x)}{\cos(2x)} = \text{RHS}\end{aligned}$$

$$\text{y. } \sin(4x) = 4 \sin x \cos x - 8 \sin^3 x \cos x$$

$$\text{Ans: LHS} = \sin(4x) = \sin(2(2x)) = 2 \sin(2x) \cos(2x) = 2(2 \sin x \cos x)(1 - 2 \sin^2 x) = 4 \sin x \cos x(1 - 2 \sin^2 x) = 4 \sin x \cos x - 8 \sin^3 x \cos x = \text{RHS}$$

$$\text{z. } \cos(4x) = 8 \cos^4 x - 8(\cos^2 x) + 1$$

$$\begin{aligned}\text{Ans: LHS} &= \cos(4x) = \cos(2(2x)) = 2 \cos^2(2x) - 1 = 2 [\cos(2x)]^2 - 1 = 2 [2 \cos^2 x - 1]^2 - 1 = 2 (4 \cos^4 x - 4 \cos^2 x + 1) - 1 = 8 \cos^4 x - 8 \cos^2 x + 2 - 1 = 8 \cos^4 x - 8 \cos^2 x + 1 = \text{RHS}\end{aligned}$$

$$\text{aa. } \sin(2x) = \frac{2}{\cot x + \tan x}$$

$$\text{Ans: RHS} = \frac{2}{\cot x + \tan x} = \frac{2}{\frac{\cos x}{\sin x} + \frac{\sin x}{\cos x}} = \frac{2}{\frac{\cos^2 x}{\sin x \cos x} + \frac{\sin^2 x}{\sin x \cos x}} = \frac{2}{\frac{\cos^2 x + \sin^2 x}{\sin x \cos x}} =$$

$$\frac{2 \sin x \cos x}{\cos^2 x + \sin^2 x} = \frac{2 \sin x \cos x}{1} = 2 \sin x \cos x = \sin(2x) = \text{LHS}$$

bb.  $\cos(2x) = \frac{1}{1 + \tan(2x) \tan x}$

$$\begin{aligned} \text{Ans: RHS} &= \frac{1}{1 + \tan(2x) \tan x} = \frac{1}{1 + \frac{2 \tan x}{1 - \tan^2 x} \cdot \tan x} = \frac{1}{1 + \frac{2 \tan^2 x}{1 - \tan^2 x}} = \frac{1}{\frac{1 - \tan^2 x}{1 - \tan^2 x} + \frac{2 \tan^2 x}{1 - \tan^2 x}} = \\ &= \frac{1}{\frac{1 - \tan^2 x + 2 \tan^2 x}{1 - \tan^2 x}} = \frac{1}{\frac{1 + \tan^2 x}{1 - \tan^2 x}} = \frac{1 - \tan^2 x}{1 + \tan^2 x} = \frac{1 - \tan^2 x}{\sec^2 x} = (1 - \tan^2 x) \cdot \frac{1}{\sec^2 x} = \end{aligned}$$

$$(1 - \tan^2 x) \cdot (\cos^2 x) = \cos^2 x - \tan^2 x \cos^2 x = \cos^2 x - \frac{\sin^2 x}{\cos^2 x} \cdot \cos^2 x = \cos^2 x - \sin^2 x = \cos(2x) = \text{LHS}$$

cc.  $\tan(2x) = \frac{2 \tan x}{1 - \tan^2 x}$

$$\begin{aligned} \text{Ans: LHS} &= \tan(2x) \frac{\sin(2x)}{\cos(2x)} = \frac{2 \sin x \cos x}{\cos^2 x - \sin^2 x} = \frac{(2 \sin x \cos x) \cdot \frac{1}{\cos^2 x}}{(\cos^2 x - \sin^2 x) \cdot \frac{1}{\cos^2 x}} = \frac{\frac{2 \sin x \cos x}{\cos^2 x}}{\frac{\cos^2 x - \sin^2 x}{\cos^2 x}} = \\ &= \frac{\frac{2 \sin x}{\cos x}}{\frac{\cos^2 x}{\cos^2 x} - \frac{\sin^2 x}{\cos^2 x}} = \frac{\frac{2 \sin x}{\cos x}}{1 - \frac{\sin^2 x}{\cos^2 x}} = \frac{2 \tan x}{1 - \tan^2 x} = \text{RHS} \end{aligned}$$

dd.  $\sin(2x) = \frac{2 \tan x}{1 + \tan^2 x}$

$$\begin{aligned} \text{Ans: RHS} &= \frac{2 \tan x}{1 + \tan^2 x} = \frac{\frac{2 \sin x}{\cos x}}{1 + \frac{\sin^2 x}{\cos^2 x}} = \frac{\frac{2 \sin x}{\cos x}}{\frac{\cos^2 x}{\cos^2 x} + \frac{\sin^2 x}{\cos^2 x}} = \frac{\frac{2 \sin x}{\cos x}}{\frac{\cos^2 x \sin^2 x}{\cos^2 x}} = \frac{2 \sin x}{\cos x} \cdot \\ &\frac{\cos^2 x}{\cos^2 x + \sin^2 x} = \frac{2 \sin x \cos^2 x}{\cos x (1)} = 2 \sin x \cos x = \sin(2x) = \text{LHS} \end{aligned}$$

ee.  $\frac{\sin x + \sin y}{\sin x - \sin y} = \frac{\tan \left[ \frac{1}{2} (x + y) \right]}{\tan \left[ \frac{1}{2} (x - y) \right]}$

$$\begin{aligned} \text{Ans: LHS} &= \frac{\sin x + \sin y}{\sin x - \sin y} = \frac{2 \sin \left( \frac{x+y}{2} \right) \cos \left( \frac{x-y}{2} \right)}{2 \cos \left( \frac{x+y}{2} \right) \sin \left( \frac{x-y}{2} \right)} = \frac{2 \sin \left( \frac{x+y}{2} \right)}{2 \cos \left( \frac{x+y}{2} \right)} \cdot \frac{\cos \left( \frac{x-y}{2} \right)}{\sin \left( \frac{x-y}{2} \right)} = \\ &\tan \left( \frac{x+y}{2} \right) \cdot \cot \left( \frac{x-y}{2} \right) = \tan \left( \frac{1}{2}(x+y) \right) \cdot \frac{1}{\tan \left( \frac{1}{2}(x-y) \right)} = \frac{\tan \left( \frac{1}{2}(x+y) \right)}{\tan \left( \frac{1}{2}(x-y) \right)} = \\ &\text{RHS} \end{aligned}$$

ff.  $\frac{1}{\tan x + \tan y} = \frac{\cos x \cos y}{\sin(x+y)}$

$$\text{Ans: RHS} = \frac{\cos x \cos y}{\sin(x+y)} = \frac{\cos x \cos y}{\sin x \cos y + \cos x \sin y} = \frac{(\cos x \cos y) \cdot \frac{1}{\cos x \cos y}}{(\sin x \cos y + \cos x \sin y) \cdot \frac{1}{\cos x \cos y}} =$$

$$\frac{\frac{\cos x \cos y}{\cos x \cos y}}{\frac{\sin x \cos y + \cos x \sin y}{\cos x \cos y}} = \frac{1}{\frac{\sin x \cos y}{\cos x \cos y} + \frac{\cos x \sin y}{\cos x \cos y}} = \frac{1}{\frac{\sin x}{\cos x} + \frac{\sin y}{\cos y}} = \frac{1}{\tan x + \tan y} = \text{LHS}$$

gg.  $(\cot^2 x + 1)(1 - \cos^2 x) = 1$

$$\text{Ans: LHS} = (\cot^2 x + 1)(1 - \cos^2 x) = (\csc^2 x)(\sin^2 x) = 1 = \text{RHS}$$

hh.  $(\tan x + \cot x)^2 = \sec^2 x \csc^2 x$

$$\text{Ans: LHS} = (\tan x + \cot x)^2 = \tan^2 x + 2 \tan x \cot x + \cot^2 x = \tan^2 x + 2 + \cot^2 x =$$

$$\tan^2 x + 1 + 1 + \cot^2 x = (\tan^2 x + 1) + (1 + \cot^2 x) = \sec^2 x + \csc^2 x =$$

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

$$\frac{1}{\sin^2 x} \cdot \frac{1}{\cos^2 x} = \csc^2 x + \sec^2 x = \text{RHS}$$