This is for Block + Friday

Proving Trig Identities (Establish the Identity).

Box the most simplified side + try that!

ALL steps must be shown. Box one side and don't touch that side. Work ~~on~~ your way from the unboxed side to the boxed side. You can not work both sides at the same time.

Angle on all trig functions!

You must show every step! You can not skip anything.

Follow PEMDAS

1. $\csc\theta \bullet \tan\theta = \boxed{\sec\theta}$

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

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

$\boxed{\sec\theta}$ ✓

2. $1 - \csc\theta\sin^3\theta = \boxed{\cos^2\theta}$

$1 - \frac{1}{\sin\theta} \cdot \sin^3\theta$

$1 - \sin^2\theta$

$\boxed{\cos^2\theta}$ ✓

3. $(\csc\theta + \cot\theta)(\csc\theta - \cot\theta) = \boxed{1}$

$\csc^2\theta - \csc\theta\cot\theta + \csc\theta\cot\theta - \cot^2\theta$

$\csc^2\theta - \cot^2\theta$

$1 + \cot^2\theta - \cot^2\theta$

$\boxed{1}$ ✓

Doesn't matter which side you box

4. $\boxed{\csc^4\theta - \csc^2\theta} = \cot^4\theta + \cot^2\theta$ factor

$\cot^2\theta(\cot^2\theta + 1)$

$\cot^2\theta \cdot \csc^2\theta$

$(\csc^2\theta - 1)\csc^2\theta$

$\boxed{\csc^4\theta - \csc^2\theta}$ ✓

I'll show both directions here,

5. $\tan\theta + \cot\theta = \sec\theta\csc\theta$

$\tan\theta + \cot\theta = \boxed{\sec\theta\csc\theta}$

$\frac{\sin\theta}{\sin\theta}\cdot\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\cdot\frac{\cos\theta}{\cos\theta}$ (need common den.)

$\frac{\sin^2\theta\ \cos^2\theta}{\sin\theta\cos\theta} = \frac{1}{\sin\theta\cos\theta} = \frac{1}{\sin\theta}\cdot\frac{1}{\cos\theta} = \csc\theta\sec\theta = \sec\theta\csc\theta$ ✓

$\boxed{\tan\theta+\cot\theta} = \sec\theta\csc\theta$

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

$\frac{1}{\cos\theta\sin\theta}$ Change 1 to $\sin^2\theta+\cos^2\theta$

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

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

6. $\frac{(1-\sin x)}{(1-\sin x)}\cdot\frac{1}{(1+\sin x)} + \frac{1}{(1-\sin x)}\cdot\frac{(1+\sin x)}{(1+\sin x)} = \boxed{2\sec^2 x}$

$\frac{1-\sin x + 1+\sin x}{(1-\sin x)(1+\sin x)} = \frac{2}{1-\sin^2 x} = \frac{2}{\cos^2 x} = 2\cdot\frac{1}{\cos^2 x} = 2\sec^2 x$ ✓

multiply by conjugate of denominator

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

$\frac{\sin x}{1+\cos x}\cdot\frac{1-\cos x}{1-\cos x} = \frac{\sin x(1-\cos x)}{1-\cos^2 x} = \frac{\sin x(1-\cos x)}{\sin^2 x} = \frac{1-\cos x}{\sin x}$ ✓

8. $\boxed{\cot^2 x} = \frac{\csc x - \sin x}{\sin x}$

mult. top & bottom by common den.

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

$$\frac{\sin x}{\sin x} \quad 9. \ \frac{\sin x}{1+\cos x}+\frac{1+\cos x}{\sin x} \cdot \frac{1+\cos x}{1+\cos x} = \boxed{2\csc x}$$

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

$$= \frac{2+2\cos x}{\sin x(1+\cos x)} = \frac{2(1+\cos x)}{\sin x(1+\cos x)} = \frac{2}{\sin x} = 2\cdot\frac{1}{\sin x} = 2\csc x \checkmark$$

$$10. \ \frac{\tan x + \cot x}{\sec x \csc x} = \boxed{1}$$

$$\frac{\frac{\sin x}{\cos x}+\frac{\cos x}{\sin x}}{\frac{1}{\cos x}\cdot\frac{1}{\sin x}} = \frac{\frac{\sin x}{\cos x}+\frac{\cos x}{\sin x}}{\frac{1}{\cos x \sin x}} \cdot \frac{\sin x \cos x}{\sin x \cos x}$$

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