

TRIGONOMETRY II - LESSON TWO

PART II ADDITION & SUBTRACTION IDENTITIES

Questions: For each of the following, write an algebraic proof.

$$1) \sec x - \sin x = \frac{1 - \sin x \cos x}{\cos x}$$

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

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

$$= \frac{1 - \sin x \cos x}{\cos x} \checkmark$$

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

$$= \sin x + \left(\frac{\sin x}{\cos x}\right) \sin x$$

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

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

$$3) \sec^2 x + \cot x = \frac{\sin x + \cos^3 x}{\cos^2 x \sin x}$$

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

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

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

$$= \frac{\sin x + \cos^3 x}{\sin x \cos^2 x} \checkmark$$

$$4) \csc^2 x - \tan x = \frac{\cos x - \sin^3 x}{\sin^2 x \cos x}$$

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

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

$$= \frac{\cos x - \sin^3 x}{\sin^2 x \cos x} \checkmark$$

$$5) \csc x - \sec x = \frac{\cos x - \sin x}{\sin x \cos x}$$

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

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

$$= \frac{\cos x - \sin x}{\sin x \cos x} \checkmark$$

$$6) \sec x - \tan x = \frac{1 - \sin x}{\cos x}$$

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

$$= \frac{1 - \sin x}{\cos x} \checkmark$$

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$$7) \cos x + \tan x = \frac{\cos^2 x + \sin x}{\cos x}$$

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

$$= \frac{\cos x}{1} \left(\frac{\cos x}{\cos x} \right) + \frac{\sin x}{\cos x}$$

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

$$8) \cot x + \sin x = \frac{\cos x + \sin^2 x}{\sin x}$$

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

$$= \frac{\cos x}{\sin x} + \frac{\sin x}{1} \left(\frac{\sin x}{\sin x} \right)$$

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

$$9) 1 + \tan x = \frac{\cos x + \sin x}{\cos x}$$

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

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

$$= \frac{\cos x + \sin x}{\cos x} \quad \checkmark$$

$$10) \csc x + 1 = \frac{1 + \sin x}{\sin x}$$

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

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

$$= \frac{1 + \sin x}{\sin x} \quad \checkmark$$

