

Warm-Up

April 14, 2017

Simplify the following expression:

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

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$$\csc^2 x - \sin^2 x \csc^2 x$$

$$\frac{1}{\sin^2 x} - \cancel{\sin^2 x} \left(\frac{1}{\cancel{\sin^2 x}} \right) \text{ rewrite}$$

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

multiply

$$\csc^2 x - 1$$

substitute

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

substitute

$$= \boxed{\cot^2 x}$$

What else can we "discover"?

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

$$\sec x = \frac{1}{\cos x}$$

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

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

add/subtract
fractions

common denominator

multiply fractions

multiply straight
across

factor

"Do they share anything?"

Pyth. ID.

add / subtract
something squared

Rewrite

in terms of $\sin x$ & $\cos x$

② $\csc x - \sin x$ Rewrite

$$\frac{1}{\sin x} - \frac{\sin x \cdot \sin x}{1 \cdot \sin x}$$

Subtract fractions

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

Pyth. ID.

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

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

Bust
it up

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

Rewrite

$$\cot x \cos x$$

$$(1 + \sin x)(1 - \sin x) = \cos^2 x$$

1	1	sin x
- sin x	- sin x	- sin² x

multiply

$$1 - \sin^2 x$$

$$\cos^2 x + \cancel{\sin^2 x} - \cancel{\sin^2 x}$$

$$\cos^2 x = \cos^2 x$$

$$(1 + \sin x)(1 - \sin x) = \cos^2 x$$

	$1 + \sin x$	
1	1	$\sin x$
$-\sin x$	$-\sin x$	$-\sin^2 x$

mult.

$$1 - \sin^2 x$$

Pyth. ID.

$$\downarrow$$

$$\cos^2 x + \cancel{\sin^2 x} - \cancel{\sin^2 x}$$

$$\cos^2 x = \cos^2 x$$

✓

NOTES: Verifying Trig Identities

Steps to verify:

1. Start with either side of the equation (left or right). *HINT - freeze the easier side*
2. Simplify the chosen side until it matches the other side.

①

$$\tan x \sin x + \cos x = \sec x$$

$$\left(\frac{\sin x}{\cos x}\right) \left(\frac{\sin x}{1}\right) + \frac{\cos x}{1} \quad \begin{array}{l} \text{Rewrite} \\ \text{Simplify} \end{array}$$

$$\frac{\sin^2 x}{\cos x} + \frac{\cos x \cdot \cos x}{1 \cdot \cos x} \quad \begin{array}{l} \text{Add} \\ \text{Fract.} \end{array}$$

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

$$\frac{1}{\cos x}$$

Pyth. Th.
Rewrite

$$\sec x = \sec x$$

Problem 3)

$$(1 + \sin x)(1 - \sin x) = \cos^2 x$$

	$1 + \sin x$	
1	1	$\sin x$
$-\sin x$	$-\sin x$	$-\sin^2 x$

multiply

$$1 - \sin^2 x$$

$$\cos^2 x + \cancel{\sin^2 x} - \cancel{\sin^2 x}$$

$$\cos^2 x = \cos^2 x$$

✓

Pyth. ID.

Problem 2

$$\csc x - \sin x = \cot x \cos x$$

$$\frac{1}{\sin x} - \frac{\sin x}{1 \cdot \sin x}$$

Rewrite
subtract
fraction

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

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

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

$$\cot x \cos x = \cot x \cos x$$

Pyth. ID.

Rewrite

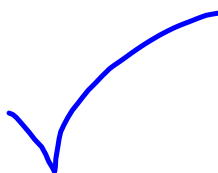
Problem 1

$$\sin x \cot x = \cos x$$

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

Rewrite

$$\cos x = \cos x$$



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

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

Rewrite
Divide

$$\frac{\cos x \cdot \cancel{\cos x}}{\sin x} + \frac{\sin x \cdot \cancel{\sin x}}{\cos x \cdot \cancel{\sin x}}$$

Add

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

Pyth. ID.

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

① Verify.

$$\tan x \sin x + \cos x = \sec x$$

$$\left(\frac{\sin x}{\cos x}\right)\left(\frac{\sin x}{1}\right) + \frac{\cos x}{1} \quad \text{Rewrite}$$

$$\frac{\sin^2 x + \cos x \cdot \cos x}{\cos x \cdot 1 \cdot \cos x} \quad \text{Like Denominator}$$

$$\frac{\sin^2 x + \cos^2 x}{\cos x} \quad \text{Pyth ID}$$

$$\frac{1}{\cos x} = \sec x$$

$$\sec x = \sec x$$

Problem 2

$$\csc x - \sin x = \cot x \cos x$$

$$\frac{1}{\sin x} - \frac{\sin x \cdot \sin x}{1 \cdot \sin x}$$

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

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

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

$$\cot x \cos x = \cot x \cos x$$

Rewrite

Subst.
Fractions

Pyth. ID.

Rewrite

Problem 1 Verify.

$$\sin x \cot x = \cos x$$

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

$$\cos x = \cos x$$

Rewrite

Simplify

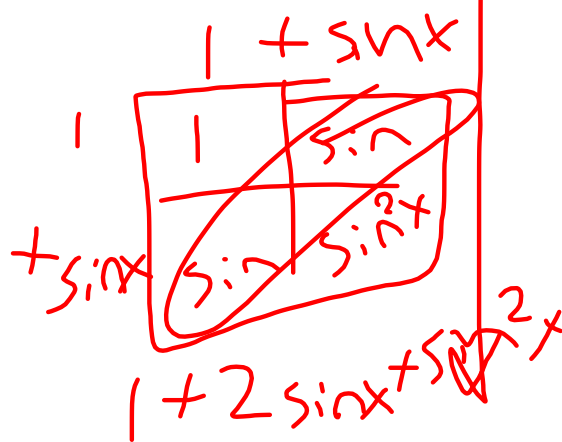
$$\textcircled{L} \cdot \frac{\overset{\text{cos}x}{\text{cos}x}}{\text{cos}x \cdot (1+\text{sin}x)} + \frac{1+\text{sin}x \cdot (1+\text{sin}x)}{(\text{cos}x) \cdot (1+\text{sin}x)} = 2\text{sec}x$$

Add

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

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

$$\frac{2+2\text{sin}x}{\dots}$$



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

$$\frac{2}{\text{cos}x}$$

$$2\left(\frac{1}{\text{cos}x}\right)$$

$$2\text{sec}x = 2\text{sec}x$$

✓

③

$$\sin x - \sin x \cos^2 x = \sin^3 x$$

Do they
share anything?

$$\sin x (1 - \cos^2 x)$$

Pyth.
ID.

$$\sin x (\cancel{\cos^2 x} + \sin^2 x - \cancel{\cos^2 x})$$

$$\sin x (\sin^2 x)$$

$$\sin^3 x = \sin^3 x$$

$$\sin x - \sin x \cos^2 x = \sin^3 x$$

Pyth.
ID.

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

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

$$\sin x - \sin x (1 - \sin^2 x)$$

mult.

$$\cancel{\sin x} - \cancel{\sin x} + \sin^3 x$$

$$\sin^3 x = \sin^3 x$$

$$\textcircled{1} \quad (\tan x) \sin x + \cos x = \sec x$$

Rewrite

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

Mult.

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

Add

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

Pyth.
ID.

$$\frac{1}{\cos x}$$

Rewrite

$$\sec x = \sec x$$

$$\textcircled{2} \quad 1 \cdot \frac{1}{\tan x} + \frac{\overset{\cdot \tan x}{1}}{\underset{1 \cdot \tan x}{\tan x}} = \frac{1}{\sin x \cos x}$$

Add fractions

$$\frac{1 + \tan^2 x}{\tan x}$$

Pyth. ID

$$\frac{\sec^2 x}{\tan x}$$

Rewrite

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

Divide

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

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

Let's try #2

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

Now verify #1!

1. $\tan x \sin x + \cos x = \sec x$

$$6. \cos^2 x = \frac{\csc x \cos x}{\tan x + \cot x}$$

Verify #8 on your own

$$8. \frac{\tan^2 x}{\tan^2 x + 1} = \sin^2 x$$

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kahoot.it



