Proving Trigonometric Identities

Nov. 19/2018

An identity is an equation which is always true for all values of the variable(s) within the domain.

To prove a trigonometric identity, manipulate one side of the equality until a form identical to the other side is reached.

When using an identity to solve for a variable, any restrictions where information is lost (e.g., dividing out factors) must be noted and incorporated into your final answer(s).

It is also possible to disprove an equality through a <u>counterexample</u>. If the equality can be shown false with a single example, it is considered to be false in general.

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Tips for working with trig identities:

- 1. Keep your goal in mind! As you work one side, keep in mind how to get closer to your target.
- 2. Start with the most complicated side and try to make it <u>simpler</u>.
- 3. If stuck, try expressing in terms of sine and cosine.
- 4. Only work on one side at a time. Only switch sides if you cannot progress any further (e.g., you are stuck, or you will make it more complicated)

Ex.1 Prove
$$\frac{\cos(x-y)}{\cos(x+y)} = \frac{1+\tan x \tan y}{1-\tan x \tan y}$$

$$US = \frac{\cos(x-y)}{\cos(x+y)}$$

$$= \frac{\cos(x-y)}{\cos(x+y)}$$

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

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

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

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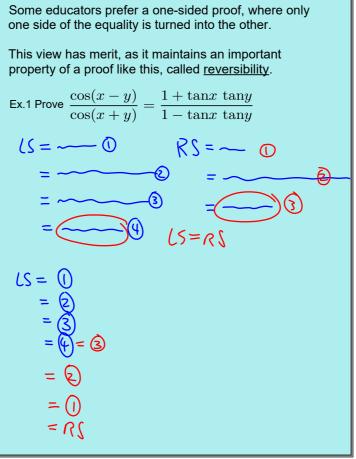
$$= \frac{\cos x \cos y - \sin x \cos y}{\cos x \cos y} = x\left(\frac{\cos x \cos y}{x}\right)$$

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

$$= \frac{\cos x \cos y}{\cos x}$$

$$=$$

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|O(e)

$$(S = \sin(\frac{\pi}{4} + x) + \sin(\frac{\pi}{4} - x))$$
 $RS = \sqrt{2} \cos x$
 $\sin(A+B) = \sin A \cos B + \cos A \sin B$
 $= \sin \frac{\pi}{4} \cos x + \cos \frac{\pi}{4} \sin x + \sin \frac{\pi}{4} \cos x - \cos \frac{\pi}{4} \sin x$
 $= 2 \sin \frac{\pi}{4} \cos x$
 $= 2 \sin \frac{\pi}{4} \cos x$
 $= \sqrt{(\frac{\sqrt{2}}{2})} \cos x$
 $= \sqrt{8}$

$$|l(e)| ls = \cot \theta - \tan \theta$$

$$RS = 2 \cot 2\theta$$

$$= \frac{2}{\tan 2\theta}$$

$$= \frac{2}{2 \tan \theta}$$

$$= \frac{2(1 - \tan^2 \theta)}{2 \tan \theta}$$

$$= \frac{1}{\tan \theta} - \frac{\tan \theta}{\tan \theta}$$

$$= \cot \theta - \tan \theta$$

$$= ls \checkmark$$

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$$8\omega^{4}x = a\cos 4x + b\cos 2x + c$$

$$\cos 2\theta = 2\cos^{2}\theta - 1 \quad 0$$

$$\cos 4\theta = 2\cos^{2}2\theta - 1 \quad 0$$

$$CS = 8\cos^{4}x \qquad 0: 2\cos^{2}x = \cos^{2}x + 1$$

$$= 2(2\cos^{2}x)^{2}$$

$$= 2(\cos^{2}x)^{2}$$

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

$$= 2\cos^{2}(2x) + 4\cos^{2}x + 2$$

$$= (\cos^{4}x + 1) + 4\cos^{2}x + 2$$

$$= 1\cos^{4}x + 4\cos^{2}x + 3$$

$$a \qquad b \qquad c$$

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