# April 8 MATH 1112 sec. 54 Spring 2019

## Section 7.3: Verifying Identities

The following equation states an Identity. I will *verify* that it is true.

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

We'll apply Identities to the left side to rewrite it until we end up with the right side.

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

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

Common denominator

$$= \frac{1-\sin^2 x}{\sin x}$$ using that common denominator

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

$$= \cos x \, \frac{\cos x}{\sin x}$$ some algebra

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

# Verifying Identities

Some things to note:

- Verifying an identity is **NOT** solving an equation.
- We do not ”do the same thing” to both sides.
- We do not assume the statement is true. We SHOW it!
- Pick one side, and apply identities to it. The goal is to transform it to the other side.
- Usually try to work with the *most complicated* side. (It’s usually easier to simplify a complicated expression than to complicate a simpler one!)
- Sometimes it helps to write everything in terms of sines and cosines—not always, but often.

Verify $\tan\left(\frac{\pi}{2} - \beta\right)\tan(\beta) = 1$

We'll start with the left side.

$$\tan\left(\frac{\pi}{2} - \beta\right)\tan\beta = \cot\beta \tan\beta$$

Cofunction ID

$\tan\left(\frac{\pi}{2} - \beta\right) = \cot\beta$

$$= \frac{1}{\tan\beta}\tan\beta$$

reciprocal ID

$\cot\beta = \frac{1}{\tan\beta}$

$$= \frac{\tan\beta}{\tan\beta}$$

$$= 1$$

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

We'll start with the left side.

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

we want to use

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

we will use

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

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

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

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

Pythagorean ID

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

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

cancel common factor