

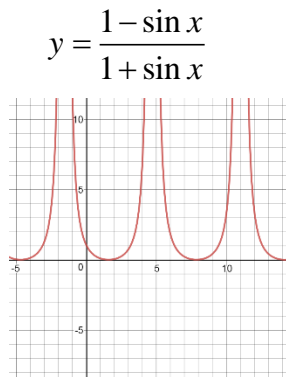
Math 229: Strategies for Proving Trigonometric Identities

Situation 1. If a question asks you to “determine whether the identity is true” then you can **check that the graph of each side is the same.** (Use Desmos!)

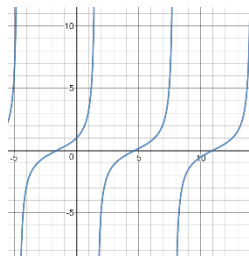
Here’s an example: I was researching some example problems for class and found this (supposed) identity that a student had asked “Dr. Math” about.

$$\text{Prove (verify) the identity: } \frac{1 - \sin x}{1 + \sin x} = \tan x + \sec x$$

Dr. Math proceeded to explain methods for proving the identity. I thought it might be a good example so tried to prove it and got nowhere. So then I graphed both sides (see below), and guess what?! It’s NOT an identity! No wonder the poor student was stuck! (Note: I mean no disrespect to Dr. Math who is taking the time to try to help others. It just goes to show that we all make mistakes, even “experts”! 😊)



$$y = \tan x + \sec x$$



Situation 2: If the problem asks you to “prove” or “verify” the identity, then start by assuming it’s true and proceed from there.

Method: Pick a side (usually the more complicated looking side but not always...see Tip #7) and transform it using the identities we’ve studied (reciprocal, ratio, even/odd, Pythagorean, sum or difference of angles, double angle) into the other side. Keep looking at the target side to judge whether you’re headed in the right direction.

Tips:

- 1) Rewrite the side you picked in terms of sine and cosine (if it isn’t already in those terms).
- 2) If you have single fractions, always think about making common denominators.
- 3) If you have compound fractions (fractions within fractions) then try clearing.
- 4) If you spot either a $\cos^2 t$ or a $\sin^2 t$, be on the lookout for applying Pythagorean Identities, or Double Angle for Cosine.
- 5) If the argument has multiple angles (example: $\sin(3x)$), try expressing it as the sum of angles ($\sin(3x) = \sin(2x + x)$) and applying the Sum of Angles Identities.
- 6) If you have a square, such as $(\sin t - \cos t)^2$, multiply it out.
- 7) If you’re getting nowhere, try working the other side of the identity instead.