

### Solving Trigonometric Proofs

#### Method 1

Pick one side of the equation (usually the most complicated side) and work with that side until it is equal to the other side

#### Method 2

Work with both sides simultaneously until they are both equal to the same expression.

### Helpful Techniques

#### Rewrite

Rewrite the expression in terms of sine and cosine only

#### Multiply by One

Multiply the numerator and denominator of a rational expression by a carefully chosen "one"

#### Combine fractions

Write sums and differences of rational expressions as a single fraction

#### Factor

Factor trigonometric expressions, using "u-substitution" as needed

#### Pythagorean Theorem

Look for combinations or portions of Pythagorean Identities. Remember that you can multiply, divide, add or subtract the identity to get a new version.

#### Goal

Always keep the goal in mind. As you manipulate one side of the equation, keep the other side in mind. Look for commonalities

### Verifying Trigonometric Identities

Video: <http://youtu.be/Rf05H8ogHLg>

### Pythagorean Identities

$$\begin{aligned}\sin^2 x + \cos^2 x &= 1 \\ \sin^2 x &= 1 - \cos^2 x \\ \cos^2 x &= 1 - \sin^2 x \\ 1 + \cot^2 x &= \csc^2 x \\ \cot^2 x &= \csc^2 x - 1 \\ \tan^2 x + 1 &= \sec^2 x \\ \tan^2 x &= \sec^2 x - 1\end{aligned}$$

Divide original Pythagorean identity by  $\sin^2 x$  or  $\cos^2 x$  to get other identities, subtract to get even more.

### Basic Trigonometric Functions

$$\begin{aligned}\sin(-x) &= -\sin(x) & \tan(x) &= \sin(x) / \cos(x) & \csc(x) &= 1/\sin(x) \\ \cos(-x) &= \cos(x) & \cot(x) &= \cos(x) / \sin(x) & \sec(x) &= 1/\cos(x) \\ \tan(-x) &= -\tan(x) & & & \cot(x) &= 1/\tan(x)\end{aligned}$$

### Complementary Angle Identities

$$\begin{aligned}\sin(\pi/2 - x) &= \cos(x) \\ \cos(\pi/2 - x) &= \sin(x) \\ \tan(\pi/2 - x) &= \cot(x)\end{aligned}$$

### Sum and Difference Identities

$$\begin{aligned}\sin(a \pm b) &= \sin(a) \cos(b) \pm \cos(a) \sin(b) \\ \cos(a \pm b) &= \cos(a) \cos(b) \mp \sin(a) \sin(b) \\ \text{Use } \sin(a \pm b) / \cos(a \pm b) &\text{ to find } \tan(a \pm b)\end{aligned}$$

### Double Angle Identities

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

