Proving Trig Identities

Tips and Tricks

Proving trig identities is like solving a puzzle; if it doesn't work this way, try that way . . .
"And he puzzled and puzzled 'till his puzzler was sore." – *Dr. Seuss*

Here are some strategies to try once you have set up your Left Side-Right Side table to work from.

Strategy	***Examples***
Switch everything to sine and cosine	$\tan x = \frac{\sin x}{\cos x}$ *or* $\sec x = \frac{1}{\cos x}$ *or* $\csc x = \frac{1}{\sin x}$
If there are fractions, create a common denominator for the entire side	$\frac{\sin^2 x}{\cos x} + \cos x = \frac{\sin^2 x}{\cos x} + \frac{\cos^2 x}{\cos x} = \frac{\sin^2 x + \cos^2 x}{\cos x}$
Try making the denominator on the left side and the right side the same	$\text{LS} = \frac{\sin^2 x}{(1-\cos x)}$ $\therefore$ $RS = 1 + \cos x = (1 + \cos x) \cdot \frac{1-\cos x}{1-\cos x}$
Remember the **Pythagorean Identity** in its 3 forms	$\sin^2 x + \cos^2 x = 1$ *or* $\sin^2 x = 1 - \cos^2 x$ *or* $\cos^2 x = 1 - \sin^2 x$
Try expanding	$(\sin x + \cos x)^2 = \sin^2 x + 2\sin x \cos x + \cos^2 x$
Try factoring	$\sin^2 x - \sin^4 x = \sin^2 x\,(1 - \sin^2 x)$
Look for a difference of squares	$1 - \cos^2 x = (1 - \cos x)(1 + \cos x)$ *or* $\sin^2 x - \cos^2 x = (\sin x - \cos x)(\sin x + \cos x)$
If both sides have only even powers of sine and cosine, try switching so that everything is either all sine or all cosine	$\sin^2 x + \cos^4 x = \sin^2 x + (\cos^2 x)^2 = \sin^2 x + (1 - \sin^2 x)^2$
You can replace any trig function with x, y and r and work with those variables instead; remember that $x^2 + y^2 = r^2$	$\sin\theta = \frac{y}{r}$ *or* $\cos\theta = \frac{x}{r}$ *or* $\tan\theta = \frac{y}{x}$
If there are compound or double angles (eg. $\sin 2x$ or $\cos(x+y)$) convert to single angles using compound or double angle formulas	$\sin 2x = 2\sin x \cos x$ *or* $\cos 2x = \cos^2 x - \sin^2 x$ *or* $\sin(x \pm y) = \sin x \cos y \pm \sin y \cos x$ *or* $\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$