

Verifying Trigonometric Identities — 8.3

Fundamental Identities

$$\csc u = \frac{1}{\sin u}$$

$$\sec u = \frac{1}{\cos u}$$

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

$$\tan u = \frac{\sin u}{\cos u}$$

$$\cot u = \frac{\cos u}{\sin u}$$

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

$$1 + \tan^2 u = \sec^2 u$$

$$1 + \cot^2 u = \csc^2 u$$

Symmetry Identities

$$\sin(-u) = -\sin u$$

$$\cos(-u) = \cos u$$

$$\tan(-u) = -\tan u$$

$$\csc(-u) = -\csc u$$

$$\sec(-u) = \sec u$$

$$\cot(-u) = -\cot u$$

Tips for Verifying Identities

1. Compare the expressions on either side of the equal sign in order to get a sense of “where to go”.
2. Remember that you may:
 - a) Write trigonometric functions in terms of sine and cosine.
 - b) Write a sum or difference as a single quotient (fraction).
 - c) Multiply by a conjugate.
 - d) Factor an expression.
 - e) Rewrite (simplify) both the right-hand side and the left-hand side into the same expression.

Verify the identity.

1. $\sin x + \cos x \cot x = \csc x$

2. $(\tan u + \cot u)(\cos u + \sin u) = \csc u + \sec u$

$$3. \quad \frac{\cot\theta - \tan\theta}{\sin\theta + \cos\theta} = \csc\theta - \sec\theta$$

$$4. \quad \frac{\cot x}{\csc x + 1} = \frac{\csc x - 1}{\cot x}$$

5. $\sin^4 \theta + 2 \sin^2 \theta \cos^2 \theta + \cos^4 \theta = 1$

6. $\frac{\csc x}{1 + \csc x} - \frac{\csc x}{1 - \csc x} = 2 \sec^2 x$

7. $\cos^4 t + 1 - \sin^4 t = 2\cos^2 t$

8. $\ln \sec \theta = -\ln \cos \theta$