

Prove each identity:

$$1. \quad \sec x - \tan x \sin x = \frac{1}{\sec x}$$

$$2. \quad \frac{1 + \cos x}{\sin x} = \csc x + \cot x$$

$$3. \quad \frac{\sec \theta \sin \theta}{\tan \theta + \cot \theta} = \sin^2 \theta$$

$$4. \quad \frac{\sec \theta}{\cos \theta} - \frac{\tan \theta}{\cot \theta} = 1$$

$$5. \quad \cos^2 y - \sin^2 y = 1 - 2\sin^2 y$$

$$6. \quad \csc^2 \theta \tan^2 \theta - 1 = \tan^2 \theta$$

$$7. \quad \frac{\sec^2 \theta}{\sec^2 \theta - 1} = \csc^2 \theta$$

$$8. \quad \tan^2 x \sin^2 x = \tan^2 x - \sin^2 x$$

$$9. (\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2 = 2$$

$$10. (\sin\theta + \cos\theta)(\tan\theta + \cot\theta) = \sec\theta + \csc\theta$$

$$11. \frac{\tan\theta - 1}{\tan\theta + 1} = \frac{1 - \cot\theta}{1 + \cot\theta}$$

$$12. \frac{1 - \tan^2 x}{1 + \tan^2 x} = 1 - 2\sin^2 x$$

$$13. \frac{\cos x + 1}{\sin^3 x} = \frac{\csc x}{1 - \cos x}$$

$$14. \csc^4 x - \cot^4 x = \csc^2 x + \cot^2 x$$

$$15. \frac{\tan\theta}{\sec\theta} + \frac{\cot\theta}{\csc\theta} = \sin\theta + \cos\theta$$

$$16. \frac{\sin y + \tan y}{1 + \sec y} = \sin y$$