

59. 
$$\frac{\sin x + \cos x}{\sec x + \csc x} = \frac{\sin x + \cos x}{\frac{1}{\cos x} + \frac{1}{\sin x}} = \frac{\sin x + \cos x}{\frac{\sin x + \cos x}{\cos x \sin x}} = (\sin x + \cos x) \frac{\cos x \sin x}{\sin x + \cos x} = \cos x \sin x$$
61. 
$$\frac{\csc x - \cot x}{\sec x - 1} = \frac{\frac{1}{\sin x} - \frac{\cos x}{\sin x}}{\frac{1}{\cos x} - 1} = \frac{\frac{1 - \cos x}{\sin x}}{\frac{1 - \cos x}{\cos x}} \cdot \frac{\sin x \cos x}{\sin x \cos x} = \frac{\cos x(1 - \cos x)}{\sin x(1 - \cos x)} = \frac{\cos x}{\sin x} = \cot x$$
63. 
$$\tan^2 u - \sin^2 u = \frac{\sin^2 u}{\cos^2 u} - \frac{\sin^2 u \cos^2 u}{\cos^2 u} = \frac{\sin^2 u}{\cos^2 u} (1 - \cos^2 u) = \tan^2 u \sin^2 u$$
65. 
$$\sec^4 x - \tan^4 x = (\sec^2 x - \tan^2 x)(\sec^2 x + \tan^2 x) = 1(\sec^2 x + \tan^2 x) = \sec^2 x + \tan^2 x$$
67. 
$$\frac{\sin \theta - \csc \theta}{\cos \theta - \cot \theta} = \frac{\sin \theta - \frac{1}{\sin \theta}}{\cos \theta - \frac{\cos \theta}{\sin \theta}} = \frac{\frac{\sin^2 \theta - 1}{\sin \theta}}{\frac{\cos \theta \sin \theta - \cos \theta}{\sin \theta}} = \frac{\cos^2 \theta}{\cos \theta(\sin \theta - 1)} = \frac{\cos \theta}{\sin \theta - 1}$$
69. 
$$\frac{\cos^2 t + \tan^2 t - 1}{\sin^2 t} = \frac{-\sin^2 t + \tan^2 t}{\sin^2 t} = -1 + \frac{\sin^2 t}{\cos^2 t} \cdot \frac{1}{\sin^2 t} = -1 + \sec^2 t = \tan^2 t$$
71. 
$$\begin{aligned} \frac{1}{\sec x + \tan x} + \frac{1}{\sec x - \tan x} &= \frac{\sec x - \tan x + \sec x + \tan x}{(\sec x + \tan x)(\sec x - \tan x)} = \frac{2 \sec x}{\sec^2 x - \tan^2 x} \\ &= \frac{2 \sec x}{1} = 2 \sec x \end{aligned}$$
73. 
$$(\tan x + \cot x)^2 = \tan^2 x + 2 \tan x \cot x + \cot^2 x = \tan^2 x + 2 + \cot^2 x = (\tan^2 x + 1) + (\cot^2 x + 1) = \sec^2 x + \csc^2 x$$
75. 
$$\frac{\sec u - 1}{\sec u + 1} = \frac{\frac{1}{\cos u} - 1}{\frac{1}{\cos u} + 1} \cdot \frac{\cos u}{\cos u} = \frac{1 - \cos u}{1 + \cos u}$$
77. 
$$\begin{aligned} \frac{\sin^3 x + \cos^3 x}{\sin x + \cos x} &= \frac{(\sin x + \cos x)(\sin^2 x - \sin x \cos x + \cos^2 x)}{\sin x + \cos x} = \sin^2 - \sin x \cos x + \cos^2 x \\ &= 1 - \sin x \cos x \end{aligned}$$
79. 
$$\begin{aligned} \frac{1 + \sin x}{1 - \sin x} &= \frac{1 + \sin x}{1 - \sin x} \cdot \frac{1 + \sin x}{1 + \sin x} = \frac{(1 + \sin x)^2}{1 - \sin^2 x} = \frac{(1 + \sin x)^2}{\cos^2 x} = \left( \frac{1 + \sin x}{\cos x} \right)^2 \\ &= (\tan x + \sec x)^2 \end{aligned}$$