Trig Derivatives

1. $f(x) = \dfrac{\sin x}{x + \tan x}$ $\quad f'(x) = \dfrac{(x+\tan x)\cos x - \sin x\left[1 + \sec^2 x\right]}{(x+\tan x)^2}$

$$= \frac{x\cos x + \cos x \tan x - \sin x - \sin x \sec^2 x}{(x+\tan x)^2}$$

$$= \frac{x\cos x + \sin x - \sin x - \sin x \sec^2 x}{(x+\tan x)^2}$$

$$= \boxed{\frac{x\cos x - \sin x \sec^2 x}{(x+\tan x)^2}}$$

2. $g(x) = \dfrac{x}{\sec x} = x\cos x \quad g'(x) = x(-\sin x) + \cos x$

$$= \boxed{\cos x - x\sin x}$$

3. $h(x) = \sin x \cos x \quad h'(x) = \sin x(-\sin x) + \cos x(\cos x)$

$$= \cos^2 x - \sin^2 x = \boxed{\cos 2x}$$

4. $f(x) = \frac{1}{\sin^2 x} = \csc^2 x = \csc x \csc x$

$f'(x) = -\csc x \cot x \csc x + -\csc x \cot x \csc x$

$= \boxed{-2\csc^2 x \cot x}$

5. $g(x) = x^3 \cot x \qquad g'(x) = x^3(-\csc^2 x) + 3x^2 \cot x$

$= \boxed{3x^2 \cot x - x^3 \csc^2 x}$

6. $h(x) = (3x^2 - 5x + 1)\tan x \qquad \boxed{h'(x) = (3x^2 - 5x + 1)(\sec^2 x) + (6x - 5)\tan x}$