1. Which of the following correctly shows the derivation of $\frac{d}{dx}(\sec x)$?

$\frac{1}{\cos x}$

Quotient Rule

(A) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{1}{\frac{d}{dx}(\cos x)} = \frac{1}{\sin x}$

(B) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{1}{\frac{d}{dx}(\cos x)} = \frac{1}{-\sin x}$

(C) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{\frac{d}{dx}(1)\cdot\cos x - 1\cdot\frac{d}{dx}(\cos x)}{(\cos x)^2} = \frac{0\cdot\cos x - 1\cdot(-\sin x)}{(\cos x)^2}$

(D) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{\frac{d}{dx}(1)\cdot\cos x + 1\cdot\frac{d}{dx}(\cos x)}{(\cos x)^2} = \frac{0\cdot\cos x + 1\cdot(-\sin x)}{(\cos x)^2}$

$$\frac{(\cos x \cdot 0) - (1 \cdot -\sin x)}{(\cos x)^2}$$

2. If $f(x) = \tan x$, then $\lim_{x \to \frac{\pi}{4}} \frac{f(x) - f\left(\frac{\pi}{4}\right)}{x - \frac{\pi}{4}}$ is

(A) 0

(B) $\tan\left(\frac{\pi}{4}\right)$

(C) $\sec^2\left(\frac{\pi}{4}\right)$ ✓

(D) nonexistent

* Remember the limit expression is also the definition of the derivative of $\tan x$ at $\frac{\pi}{4}$

Therefore $\frac{d}{dx} \tan x \Big|_{x \to \frac{\pi}{4}}$

$\sec^2\left(\frac{\pi}{4}\right)$

6. Which of the following correctly shows the derivation of $\frac{d}{dx}(\cot x)$? $= \frac{1}{\tan x}$

(A) $\frac{d}{dx}(\cot x) = \frac{d}{dx}\left(\frac{1}{\tan x}\right) = \frac{1}{\frac{d}{dx}(\tan x)} = \frac{-1}{\sec^2 x}$

Quotient Rule

(B) $\frac{d}{dx}(\cot x) = \frac{d}{dx}\left(\frac{1}{\tan x}\right) = \frac{1}{\frac{d}{dx}(\tan x)} = \frac{1}{\sec^2 x}$

(C) ✓ $\frac{d}{dx}(\cot x) = \frac{d}{dx}\left(\frac{1}{\tan x}\right) = \frac{\tan x \frac{d}{dx}(1) - 1 \cdot \frac{d}{dx}(\tan x)}{\tan^2 x} = \frac{(\tan x)\cdot 0 - \sec^2 x}{\tan^2 x} = -\frac{\sec^2 x}{\tan^2 x}$

(D) $\frac{d}{dx}(\cot x) = \frac{d}{dx}\left(\frac{1}{\tan x}\right) = \frac{\tan x \frac{d}{dx}(1) + 1 \cdot \frac{d}{dx}(\tan x)}{\tan^2 x} = \frac{\tan x \cdot 0 + \sec^2 x}{\tan^2 x} = \frac{\sec^2 x}{\tan^2 x}$

$\frac{(\tan x \cdot 0) - (1 \cdot \sec^2 x)}{(\tan x)^2} = \frac{-\sec^2 x}{\tan^2 x}$