Find the derivative of

$y = \tan x$	$y' = \sec^2 x$
$y = \sec x$	$y' = \sec x \tan x$
$y = \csc x$	$y' = -\csc x \cot x$
$y = \cot x$	$y' = -\csc^2 x$
$y = \sin x$	$y' = \cos x$
$y = \cos x$	$y' = -\sin x$

$$y = \tan x$$

$$y = \frac{\sin x}{\cos x} \qquad y' = \frac{(\sin x)'(\cos x) - (\cos x)'(\sin x)}{\cos^2 x}$$

$$y' = \frac{\cos^2 x + \sin^2 x}{\cos^2 x}$$

$$\boxed{y' = \frac{1}{\cos^2 x}} \rightarrow \sec^2 x$$

$$y = \sec x = \frac{1}{\cos x} = (\cos x)^{-1}$$

$$y' = -1(\cos x)^{-2}(-\sin x)$$

$$= \frac{\sin x}{\cos x \cdot \cos x} = \tan x \sec x$$

$y = \csc x = (\sin x)^{-1} = -1(\sin x)^{-2} \cdot \cos x$

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

$-$Cotant Cosec

$-\cot x \csc x$

$$y = \cot x = \frac{1}{\tan x} = (\tan x)^{-1}$$

$$y' = -1\,(\tan x)^{-2} \cdot \sec^2 x$$

$$= -\frac{\sec^2 x}{\tan^2 x} = -\frac{\frac{1}{\cancel{\cos^2 x}} \cdot \cancel{\cos^2 x}}{\frac{\sin^2 x}{\cancel{\cos^2 x}} \cdot \cancel{\cos^2 x}} = \frac{-1}{\sin^2 x}$$

$$= -\csc^2 x$$

6. If $f(x) = \dfrac{x}{\tan x}$, then $f'\left(\dfrac{\pi}{4}\right) =$

(A) 2 (B) $\dfrac{1}{2}$ (C) $1+\dfrac{\pi}{2}$ (D) $\dfrac{\pi}{2}-1$ (E) $1-\dfrac{\pi}{2}$

$$\cos\frac{\pi}{4} = \frac{\sqrt{2}}{2} \rightarrow \sec\left(\frac{\pi}{4}\right) = \frac{2}{\sqrt{2}} = \sqrt{2}$$

$$f' = \left.\frac{\tan x - x\sec^2 x}{\tan^2 x}\right|_{x=\frac{\pi}{4}} = \frac{1 - \left(\frac{\pi}{4}\right)(2)}{(1)^2}$$

$$= 1 - \frac{\pi}{2}$$

7. $\frac{d}{dx}\cos^2(x^3) = \frac{d}{dx}\left(\cos(x^3)\right)^2$

(A) $6x^2\sin(x^3)\cos(x^3)$

(B) $6x^2\cos(x^3)$

(C) $\sin^2(x^3)$

(D) $-6x^2\sin(x^3)\cos(x^3)$

(E) $-2\sin(x^3)\cos(x^3)$

$\underbrace{2\cos(x^3)\cdot(-\sin(x^3))}\cdot 3x^2$

$-6x^2\sin(x^3)\cos(x^3)$

or

$-3x^2\sin(2x^3)$