Name_____

Find the derivative of each of the following functions and SIMPLIFY as much as possible.

1) $y = \ln(\cos x)$ *(2 points)*

$$y' = \frac{1}{\cos x} \cdot -\sin x$$

$$\boxed{= -\tan x}$$

2) $y = \ln(\sec x + \tan x)$ *(4 points)*

$$\begin{aligned} y' &= \frac{1}{\sec x + \tan x} \cdot (\sec x \tan x + \sec^2 x) \\ &= \frac{1}{\sec x + \tan x} \cdot \sec x \cdot (\tan x + \sec x) \\ &= \frac{1}{\sec x + \tan x} \cdot (\sec x + \tan x) \cdot \sec x \end{aligned}$$

$$\boxed{= \sec x}$$

3) Choose one of the two following functions, find its derivative, and SIMPLIFY as much as possible. You may choose to find the derivative of both functions; in which case, I will give you credit for which ever one is most correct. *(4 points)*

a) $y = 2\sqrt{x}\tan^{-1}(\sqrt{x})$

b) $y = 2\sqrt{x}\sin^{-1}(\sqrt{x})$

$$\begin{aligned} y' &= 2\sqrt{x} \cdot \frac{1}{1+(\sqrt{x})^2} \cdot \frac{1}{2} \cdot (x)^{-1/2} + 2 \cdot \frac{1}{2} \cdot (x)^{-1/2} \cdot \tan^{-1}(\sqrt{x}) \\ &= \sqrt{x} \cdot \frac{1}{1+x} \cdot \frac{1}{\sqrt{x}} + \frac{1}{\sqrt{x}} \cdot \tan^{-1}(\sqrt{x}) \end{aligned}$$

$$\boxed{= \frac{1}{1+x} + \frac{\tan^{-1}(\sqrt{x})}{\sqrt{x}}}$$

or

$$\begin{aligned} y' &= 2\sqrt{x} \cdot \frac{1}{\sqrt{1-(\sqrt{x})^2}} \cdot \frac{1}{2} \cdot (x)^{-1/2} + 2 \cdot \frac{1}{2} \cdot (x)^{-1/2} \cdot \sin^{-1}(\sqrt{x}) \\ &= \sqrt{x} \cdot \frac{1}{\sqrt{1-x}} \cdot \frac{1}{\sqrt{x}} + \frac{1}{\sqrt{x}} \cdot \sin^{-1}(\sqrt{x}) \end{aligned}$$

$$\boxed{= \frac{1}{\sqrt{1-x}} + \frac{\sin^{-1}(\sqrt{x})}{\sqrt{x}}}$$

BONUS: Earlier in the semester, I wore a very "inspiring" math-related t-shirt to class. What was the message on that t-shirt? *(1 point)*

CALCULUS RULES!

(You know, like Product Rule, Quotient Rule, Chain Rule, etc.)