Score: _____ out of 10.

Math 201 - Quiz #5 Name: Key

1. **Solve as few or as many as you think you need to maximize your score. Please put an X through the parts you do not want graded.** Compute the derivative for each of the following. Full simplification is not necessary, but your final answer should not have any derivatives and all answers should be functions in the appropriate variable.

(a) $y = \ln(\cos(3x) + 1)$

$$y' = \frac{1}{\cos(3x)+1}\left(-\sin(3x)\cdot 3\right)$$

answer: $\dfrac{-3\sin(3x)}{\cos(3x)+1}$

(b) $y = \log_2(x)\sin^{-1}(x)$

$$y' = \log_2(x)\frac{1}{\sqrt{1-x^2}} + \sin^{-1}(x)\left(\frac{1}{\ln(2)\,x}\right)$$

answer: $\log_2(x)\left(\dfrac{1}{\sqrt{1-x^2}}\right) + \sin^{-1}(x)\left(\dfrac{1}{\ln(2)\,x}\right)$

(c) $y = \tan^{-1}(2x^3 + 1)$

$$y' = \frac{1}{1+(2x^3+1)^2}\frac{d}{dx}(2x^3+1)$$

answer: $\dfrac{6x^2}{1+(2x^3+1)^2}$

(d) $y = x^{\sin(x)}$

$$\ln y = \ln\left(x^{\sin x}\right)$$

$$\ln y = \sin x \cdot \ln(x)$$

$$\frac{d}{dx}(\ln y) = \frac{d}{dx}\left(\sin x \cdot \ln(x)\right)$$

$$\frac{1}{y}\frac{dy}{dx} = \sin x\left(\frac{1}{x}\right) + \ln(x)\left(\cos(x)\right)$$

$$\frac{dy}{dx} = y\left(\frac{\sin x}{x} + \ln(x)\cos(x)\right)$$

answer: $\frac{dy}{dx} = x^{\sin x}\left(\frac{\sin x}{x} + \ln(x)\cos(x)\right)$

(e) $y = \frac{x\cos(3x)\sqrt{1+x}}{e^{2x+3}(1-2x)^3}$

$$\ln(y) = \ln\left(\frac{x\cos(3x)\sqrt{1+x}}{e^{2x+3}(1-2x)^3}\right)$$

$$\ln(y) = \ln x + \ln\cos(3x) + \ln\left((1+x)^{1/2}\right) - \left[\ln\left(e^{2x+3}\right) + \ln\left((1-2x)^3\right)\right]$$

$$\ln(y) = \ln(x) + \ln(\cos(3x)) + \frac{1}{2}\ln(1+x) - (2x+3) - 3\ln(1-2x)$$

$$\frac{d}{dx}\ln(y) = \frac{d}{dx}\left(\right)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{x} + \frac{1}{\cos(3x)}(-\sin(3x))(3) + \frac{1}{2(1+x)} - 2 - \frac{3}{1-2x}(-2)$$

$$\frac{dy}{dx} = \left(\frac{x\cos(3x)\sqrt{1+x}}{e^{2x+3}(1-2x)^3}\right)\left(\frac{1}{x} - 3\tan(3x) + \frac{1}{2(1+x)} - 2 + \frac{6}{1-2x}\right)$$

answer: $\frac{dy}{dx}$