

Math 131 - Quiz 9

October 29, 2025

Name key

Score _____

Show all work to receive credit. Supply explanations where necessary.

1. (2 points) Let $f(x) = x \cos^{-1}(2x)$. Find $f'(x)$. Then find the exact value (not a decimal approximation) of $f'(0)$

$$f'(x) = \cos^{-1}(2x) + x \left(\frac{-1}{\sqrt{1-(2x)^2}} \right) (2)$$

$$f'(0) = \cos^{-1}(0) = \frac{\pi}{2}$$

$$f'(x) = \cos^{-1}(2x) - \frac{2x}{\sqrt{1-4x^2}}$$

2. (5 points) Determine each derivative.

(a) $\frac{d}{dx} e^{4x} \sin(2x)$

$$= 4e^{4x} \sin(2x) + 2e^{4x} \cos(2x)$$

(b) $\frac{d}{du} \tan^{-1}(u^3) =$

$$\frac{3u^2}{1+u^6}$$

(c) $\frac{d}{dx} \ln(x + \sqrt{x}) = \frac{1}{x + \sqrt{x}} \left(1 + \frac{1}{2} x^{-1/2} \right) =$

$$\frac{1 + \frac{1}{2} x^{-1/2}}{x + \sqrt{x}}$$

3. (3 points) Let $F(x) = \ln \left(\frac{x^4 e^{2x}}{(2x+5)^3} \right)$. Use the logarithm laws to expand $F(x)$. Then determine $F'(x)$.

$$F(x) = 4 \ln x + 2x \ln e - 3 \ln(2x+5)$$

$$F(x) = 4 \ln x + 2x - 3 \ln(2x+5)$$

$$F'(x) = \frac{4}{x} + 2 - \frac{6}{2x+5}$$