Math 113: Quiz 6

Instructions: Answer all questions. Show all of your work. Partial credit may be given. The use of calculators is not allowed. Please turn off and put away all mobile electronic devices - accessing these devices between the time you receive your quiz and the time you turn in your quiz constitutes an honor code violation.

1. (6 pts) Find the derivative of the following functions

   \[ f(x) = x \ln x \]
   \[ f'(x) = \frac{d}{dx} (x \ln x) = x \cdot \frac{1}{x} + \ln x = 1 + \ln x \]

   \[ f(x) = \log_2(1 + 5x^2) \]
   \[ f'(x) = \frac{1}{(1 + 5x^2) \cdot \ln 2} \cdot 10x = \frac{10x}{(1 + 5x^2) \ln 2} \]

   \[ f(x) = \sin^{-1}(8x) \]
   \[ f'(x) = \frac{1}{\sqrt{1 - (8x)^2}} \cdot 8 \]

2. (4 pts) Find \( dy/dx \) if

   \[ y + \sin(y) = e^{2x} + xy \]

   \[ \text{Step 1:} \quad \frac{dy}{dx}(y + \sin(y)) = \frac{d}{dx}(e^{2x} + xy) \]

   \[ \frac{dy}{dx} + \cos(y) \cdot \frac{dy}{dx} = 2e^{2x} + x \cdot \frac{dy}{dx} + y \cdot \frac{dx}{dx} \]

   \[ = 1 \]

   \[ \frac{dy}{dx} + \cos(y) \cdot \frac{dy}{dx} - x \cdot \frac{dy}{dx} = 2e^{2x} + y \]

   \[ \frac{dy}{dx} \left( 1 + \cos(y) - x \right) = 2e^{2x} + y \]

   \[ \frac{dy}{dx} = \frac{2e^{2x} + y}{1 + \cos(y) - x} \]

   \[ \frac{dy}{dx} = \frac{2e^{2x} + y}{1 - \cos(y) - x} \]