QUESTION 2 [20 marks]

(a) Show that the \( \frac{dy}{dx} = \frac{xy \ln(10) - y}{x + e^y xy \ln(10)} \) and \( \frac{dx}{dy} = \frac{x + e^y xy \ln(10)}{xy \ln(10) - y} \) for equation \( \log_{10}(xy) + e^y = x \). (5 marks)

(b) Assuming that the following equations define \( x \) and \( y \) implicitly as differentiable functions \( x = f(t) \) and \( y = g(t) \), find \( \frac{dy}{dx} \) at \( t = \pi \).

\[ x \cos(t) + 2x = t \quad t \tan(t) - 2t = y \]

Ans: \( \frac{dy}{dx} = \frac{\tan(t) + x \sec^2(t) - 2}{1 + x \sin(t)} \)

\[ \frac{dy}{dx}(\pi) = \pi - 2 \]

(10 marks)

(c) The \( f'(x) \) for \( f(x) = (3x^4 + 5x^2)^2 \) is \( 72x^7 + 180x^5 + 100x^3 \). Verify it using Quotient Rule. (5 marks)