1. Find the derivative of each of the following functions. You do not need to simplify your answers.

1A. \( m(x) = e^{\sin(2x)} \)

\[
m'(x) = \left( e^{\sin(2x)} \right)' (\sin(2x))''
\]

\[
= \left( e^{\sin(2x)} \right) \left( \cos(2x) \right) (2x)'
\]

\[
= \left( e^{\sin(2x)} \right) \cos(2x) (2x)'
\]

\[
= \exp(\sin(2x)) \cdot \cos(2x) \cdot 2
\]

**ALTERNATE NOTATION**

\[
m(x) = \exp(\sin(2x))
\]

\[
m'(x) = \exp(\sin(2x)) \cdot (\sin(2x))'
\]

\[
= \exp(\sin(2x)) \cdot \cos(2x) \cdot 2
\]

1B. \( q(x) = (x^3 + \log_2 x) x^5 \)

\[
q'(x) = \left( 3x^2 + \frac{1}{\ln 2 \cdot x} \right) (x^5) + (x^3 + \log_2 x) (5x^4)
\]

1C. \( k(x) = \ln(\sqrt{x^4 + \cos(7x)} + x^5) \)

\[
k'(x) = \frac{1}{(x^4 + \cos(7x))^{\frac{1}{2}} + x^5}
\]

\[
= \left( \frac{\frac{1}{2} (x^4 + \cos(7x))^{-\frac{1}{2}}}{(x^4 + \cos(7x))^{\frac{1}{2}} + x^5} \cdot \frac{1}{(x^4 + \cos(7x))^{\frac{1}{2}} + x^5} \right)
\]

\[
= \left( \frac{1}{2} (x^4 + \cos(7x))^{-\frac{1}{2}} \right)
\]

\[
= \frac{1}{2} (x^4 + \cos(7x))^{-\frac{1}{2}} \cdot \left( x^4 + \cos(7x) \right) + 3x^4
\]

1D. \( p(x) = \frac{\sin(x) + x^6}{x^5 + \cos(x)} \)

\[
p'(x) = \frac{(x^5 + \cos(x))(\cos(x) + 6x^5) - (5x^4 - \sin x)(\sin(x) + x^6)}{(x^5 + \cos(x))^2}
\]

\[
= \frac{(x^5 + \cos(x))(\cos(x) + 6x^5) - (5x^4 - \sin x)(\sin(x) + x^6)}{(x^5 + \cos(x))^2}
\]

**THIS QUIZ CONTINUES ON THE OTHER SIDE!**
2. The equation \( x^4 + y^3 = x^2 y^2 + 1 \) implicitly defines \( y \) as a function of \( x \), and a graph of this equation is shown at the bottom of the page.

2A. Use implicit differentiation to find \( y' \).

\[
\frac{d}{dx} (x^4 + y^3) = \frac{d}{dx} (x^2 y^2 + 1)
\]

\[
y' x^3 + 3y^2 y' = 2xy^2 + x^2 2y \cdot y'
\]

Product rule on \( x^2 y^2 \)

solve for \( y' \):

\[
3y^2 y' - x^2 2y y' = 2xy^2 - 4x^3
\]

\[
y' (3y^2 - x^2 2y) = 2xy^2 - 4x^3 ; y' = \frac{2xy^2 - 4x^3}{3y^2 - x^2 2y}
\]

2B. The graph implies that \((1, 1)\) is a solution of the equation; show that \((1, 1)\) does indeed satisfy the equation.

\[
\text{does } 1^4 + 1^3 = 1^2 + 1^2 + 1 \text{ ? does } 1 + 1 = 1 + 1 \text{ ? does } 2 = 2? \quad \text{yes to all.}
\]

2C. Use the answer to 2A to find the slope of the graph of the equation at \((1, 1)\).

\[
\left. y' \right|_{(x,y)=(1,1)} = \frac{2 \cdot 1 \cdot 1^2 - 4 \cdot 1^3}{3 \cdot 1^2 - 1^2 2} = \frac{2-4}{3-2} = \frac{-2}{1} = -2
\]

This seems reasonable; I've sketched the tangent line here.