Show all work and don’t forget to check your answers.

1. (3 points) Find the linear approximation \( L(x, y) \) of \( f(x, y) = \ln(x^2 - 3y) \) at \((1, 0)\), and use this to approximate \( f(1.1, 0.1) \).

2. (3 points) If \( w = f(x, y) = e^x \ln y \), \( x(t) = t \) and \( y(t) = t^3 \). Then find \( \frac{dw}{dt} \) when \( t = 1 \).

3. (4 points) Find the derivative of \( f(x, y) = x^2 \sin y \) in the direction of \( \begin{bmatrix} 2 \\ -1 \end{bmatrix} \).