Solve the following problems. Show your work and use correct notation.

1. Let \( \sin(xy) = e^{2x}y \). Find \( \frac{dy}{dx} \) in terms of \( x \) and \( y \).

   \( Solution. \)

   \[
   \frac{d}{dx} \sin(x,y) = \frac{d}{dx} e^{2x}y
   \]

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

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

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

2. Suppose that the differentiable function \( y = f(x) \) has an inverse and that the graph of \( f \) passes through the point \((3,10)\) and has a slope of 7 there. Find the value of \( \frac{df^{-1}}{dx} \) at \( x = 10 \).

   \( Solution. \)

   Observe that \( f(3) = 10, f^{-1}(10) = 3, \) and \( f'(3) = 7 \). Then

   \[
   f^{-1}(10) = \frac{1}{f'(f^{-1}(10))} = \frac{1}{f'(3)} = \frac{1}{7}
   \]