Calculus 3.5 - Implicit Differentiation

Review Problems

1. **Finding derivatives.** Find derivatives of the following functions:
   
   (a) \( f(x) = x \sin(\ln(x)) \)
   
   (b) \( g(x) = \frac{\ln(x)}{x^2 + 1} \)

   **Basic Knowledge**

2. Find \( \frac{dy}{dx} \) by using implicit differentiation:
   
   (a) \( 2x^2 + 3y^2 = 7 \)
   
   (b) \( x^2y - 3x^4 = 1 \)
   
   (c) \( x \sin(y) + y^3 = 3x \)
   
   (d) \( ye^{3xy} + 2y^2 = 0 \)

3. Find the equation of a line tangent and a line normal to the graph of the given equation at the given point:
   
   (a) \( x^2 + 2y^3 = 3 \) at \((-1, 1)\)
   
   (b) \( y \sin(x) + \cos(x) = \sqrt{2} \) at \(\left(\frac{\pi}{4}, 1\right)\)

   **Intermediate Knowledge**

4. Find points at which the graph of \( x^2 + 4y^2 = 16 \) has
   
   (a) horizontal tangent line(s)
   
   (b) vertical tangent line(s)

   **Advanced Knowledge**

5. Find \( \frac{d^2y}{dx^2} \) for \( xy + 2x^4 = 10 \).